1975
USDA Forest Service Research Paper PNW-189

# A Technique and Relationships for Projections of Employment in the Pacific Coast Forest Products Industries

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## Abstract

This paper presents a technique for estimating forest industry employment in the future. The authors have developed historic employment-wood consumption relationships by industry segment and geographic area. Employment trends by geographic area and industry sector are presented as essential background for projection evaluation. Seasonality information is presented to allow the interpretation of the seasonal characteristics of the employment sectors being projected.


Keywords: Forest product industries, employment (forest labor), employment (seasonal).

# CONTENTS

# INTRODUCTION

In much of Washington, Oregon, and California, the forest industries are a major source of income and employment. Employment instability in these industries can cause severe hardships on individuals and families and economic distress in local and regional economies. In recent years there has been a realization that current high levels of timber harvest and product output on the Pacific coast, which have been sustained by harvest of diminishing reserves of old-growth timber, cannot be sustained for many more years. And more and more demands are being made for alternative uses of the region's timberlands, some of which diminish the timber output from those lands. The prospects for tightened timber supplies on the Pacific coast have implications for prices and availability of wood products in the national and international markets; but of more regional concern is the potential impact on employment and the economy.

The major purpose of this paper is to provide local and regional planners, public officials, labor representatives, and others with information and a method to help them translate future levels of timber supply and wood use by industries into future levels of direct forest industrial employment in Washington, Oregon, and California.

In the first part of the paper we describe, in general, the development of employment-raw material consumption ratios based on historical data and their use for prediction of future employment. Equations are presented for estimating future ratios for specified primary wood-using industries for half-State areas in Washington, Oregon, and California, based on the historic relationships of employment and wood consumption in those areas.

The second part of the paper presents recent trends in total employment by geographic areas and industrial sectors. Since these trends include the effect of all factors influencing employment, they provide a background against which to evaluate and adjust projections based on wood input alone. They provide the basis for extrapolating future employment, assuming continuation of trends in raw material consumption, industry mix, productivity, and utilization.

The last section deals with the seasonal variations of forest industry employment. Recognition of the seasonal patterns of the various industrial sectors is essential to interpreting projected employment's impacts on the community. Seasonality data should also be helpful to regional and community planners interested in encouraging the development of other industries whose seasonal employment patterns would offset those of the forest-related industries.

The forest industrial sectors analyzed in this study are all represented in the major categories--lumber and wood products, and paper and allied products. The lumber and wood products category includes logging activities. Employment data used in this study include all persons covered by unemployment insurance in these industries, as reported by the State employment agencies in Washington, Oregon, and California. This covered employment is subject to legal limitations of the unemployment insurance acts of the States, which have changed slightly in some forest industrial sectors since 1960. However, these changes are not significant enough to affect the findings of this study.

To make the analyses and descriptive material more useful and meaningful, each State has been divided into two units, conforming to generally recognized wood-producing regions (fig. 1). These geographic divisions have basic differences in climate, tree species, harvest techniques, and manufacturing utilization, resulting in substantially different relationships between employment and raw material consumption from one area to the next, as well as different employment trends and patterns of seasonality.


*Figure 1.--Major wood producing regions of the Pacific coast.*

# DEVELOPMENT AND USE OF EMPLOYMENT-CONSUMPTION RATIOS

Total employment levels in the forest products industries depend on many factors, including demand for the industries' products, changing product mix, increased utilization, availability of raw material, levels of capital expenditure, and skill and performance levels of labor. To predict future employment levels from these and other factors, one would have to first predict future levels for all the factors. If, on the other hand, we can define a relationship between two inputs to the manufacturing process--labor and raw material--then we can predict future levels of employment based on the predicted consumption of raw material. This approach is especially effective when dealing with the question of employment impacts of limited resource supplies in the face of increasing demand for the industries' products. This part of the paper describes the development and use of the relationship between labor and raw material inputs.

To develop ratios for use in predicting employment impacts of changing material supplies, we need a historical base of employment and raw material consumption data. Employment data are generally available from State employment security departments. Raw material consumption data are often difficult to come by. We were able to get raw material consumption data for logging and pulping. However, for lumber and plywood manufacture, we had to develop consumption estimates based on historic production levels. We used recent production-consumption ratios to develop the estimates of consumption for the historic time series. This process assumes static utilization of raw material and possibly could result in an understatement of raw material use and, consequently, an overstatement of employment requirements in the early years of the time series data. The effect of this possible bias is not known, but we feel it is nominal and does not substantially affect the relationships developed in this paper.

Since the technique of employment prediction through these ratios is generally used to determine impacts of changes in resource supply, it should be used for those industries whose operations in the area of concern will be affected by resource supply changes in that area. These include the primary resource oriented manufacturing processes: logging, lumber manufacture, plywood manufacture, and conversion of wood fiber into pulp and paper stock. The ratios should not be used for typically secondary manufacturing industries, whose location is due to market, or other nonraw material considerations.

The factors that determine the level of labor input in the production process tend to change over time in most industries and most areas; consequently, the ratio of employment to raw material consumption in the production process also tends to change over time. If a trend can be identified for such ratios--that is, if we can identify the direction and rate at which they change over time--then we can extrapolate the identified trend into the future to

predict employment required per unit of raw material consumed in the production process. This approach, of course, assumes that the aggregative effects of the changes in the underlying factors which have resulted in the historical trend in employment-consumption ratio(s) will continue into the future.

The process of extrapolation needs to be tempered by judgment based on knowledge of the industry. If the extrapolated ratios seem logical when based on the prospects that past trends will continue for the region, then the extrapolated values can be used. Employment is estimated for industry segments by applying the appropiate extrapolated ratio to the harvest or wood consumption for each point in time.

Viewed by themselves, employment-wood consumption ratios do not indicate future employment. They are only relationships by which given levels of wood inputs (raw material consumption) can be translated into employment. The future level of wood inputs to industry must be estimated and the projection period specified for the area under study. Furthermore, because employment-wood consumption ratios vary by industries, both present and future industry mix should be identified. Estimates must be made of the future quantities of wood to be consumed by sawmills, veneer and plywood plants, pulpmills, etc.; and these quantities must be consistent with the projected total wood supply.

In the next section of this paper, we have graphed the historical employment-consumption ratios for the primary manufacturing activities of the two major wood-using sectors of the Pacific coast's economy, by half-State areas. And we have fitted curve forms to these historic data, which can be extrapolated for prediction purposes. Some cautions regarding use of the curve forms are suggested.

The employment-consumption ratios used in projecting employment levels should, if possible, be developed from data for the area of concern. For instance, if projections are being made for a county, use of ratios developed for large areas, such as the half-State areas presented later in this report, could be quite inappropriate and misleading. In cases of insufficient data in a small area, ratios from a broader area can be used if it can be determined that they are similar to those for the smaller area.

Some of the curves, if extended for many years, will indicate an employment-consumption ratio approaching or reaching zero employees per unit of wood consumed. This is unrealistic. In such cases the curves should be extrapolated for only short periods into the future. When extrapolations for longer time periods are required, the user must temper the curves based on the best available evidence and expert opinion of what the employment-wood consumption relationships will be like in the future.

Finally, any one of several curve forms may adequately fit the historical trend data. The potential user is then faced with making a selection. It is often expedient to select the simplest form that adequately defines the trend. But in this as well as other aspects of selection and use of ratio trends for projection of employment in the forest products industries, considerable judgment is required of the user.

## TRENDS IN EMPLOYMENT-CONSUMPTION RATIOS IN WASHINGTON, OREGON, AND CALIFORNIA

In this section we present the historic employment-consumption ratios by half-State for logging, sawmills and planing mills, plywood and veneer plants, and pulp, paper, and board plants. Ratios for the aggregates, lumber and wood products and paper and allied products, are also presented with a discussion of the appropriateness of their use. Trends are fitted to the historic ratio data for each area-industry combination, and a determination is made of whether each ratio changes significantly with the passage of time. The ratios are expressed as man-years of employment per unit of wood raw material consumed in the manufacturing process.

### Trends in logging employment-timber harvest ratios vary by State area

Logging employment-timber harvest ratios have been calculated for western Washington, eastern Washington, western Oregon, and eastern Oregon for the 1950-70 period. Ratios were also calculated for both coastal and interior California regions for 1960-71. These ratios are expressed by average annual employment per million board feet of timber harvest (local scale). To identify trends in the ratios and provide a basis for extrapolation, we have fitted curves to the data for each region. The equation and the coefficient of determination ($R^2$) for the regression are shown on the graphs.[1/] Figures 2 to 4 show that the curves vary by State area. Table 8 contains other regression equations for these data.

The linear form of the curves in figure 2 suggests that the combination of factors underlying the changing requirement for labor input was also changing at a constant rate in western and eastern Washington during the 1950-70 period. The downward sloping curves indicate that over the past two decades progressively fewer logging employees have been needed per million board feet of timber harvested (hereafter called unit harvest). The level of employment per unit harvest has been higher in western Washington than in eastern Washington or elsewhere on the Pacific coast.

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[1/] *$R^2$ is the coefficient of determination which is a measure of how well the regression line fits the sample data. $R^2$ is the proportion of the variation in the employment-consumption ratio which is associated with the passage of time.*

One factor which could affect the employment-timber harvest ratio over time would be a possible change in average weekly hours for production workers. In theory, shorter hours could increase worker productivity. However, Bureau of Labor Statistics (1972) data indicate that the average weekly hours for production workers in logging has not changed much between 1965 and 1971 in the State of Washington. In years of peak production, the average weekly hours tend to increase. In 1971, average weekly hours worked by loggers was 36.3 hours, slightly fewer than the average for the 1965-71 period. Separate data are not available for Oregon and California, but combined sawmill and logging data for these States also suggest that average weekly hours have not changed much over the past decade. The employment-timber harvest ratios have probably not been influenced by hours worked each week.

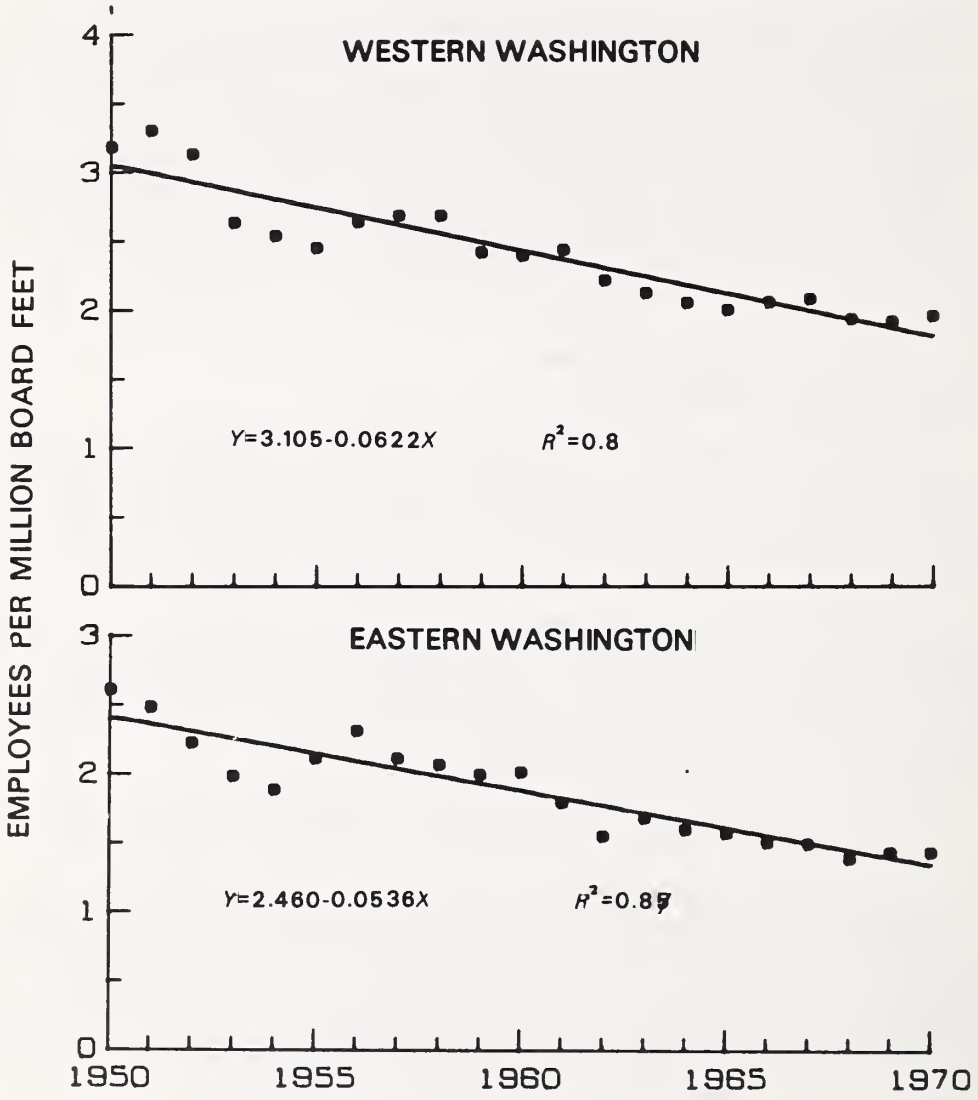



*Figure 2.--Average annual employment in logging (SIC 2411) per million board feet of wood harvested in Washington by State area, 1950-70.*

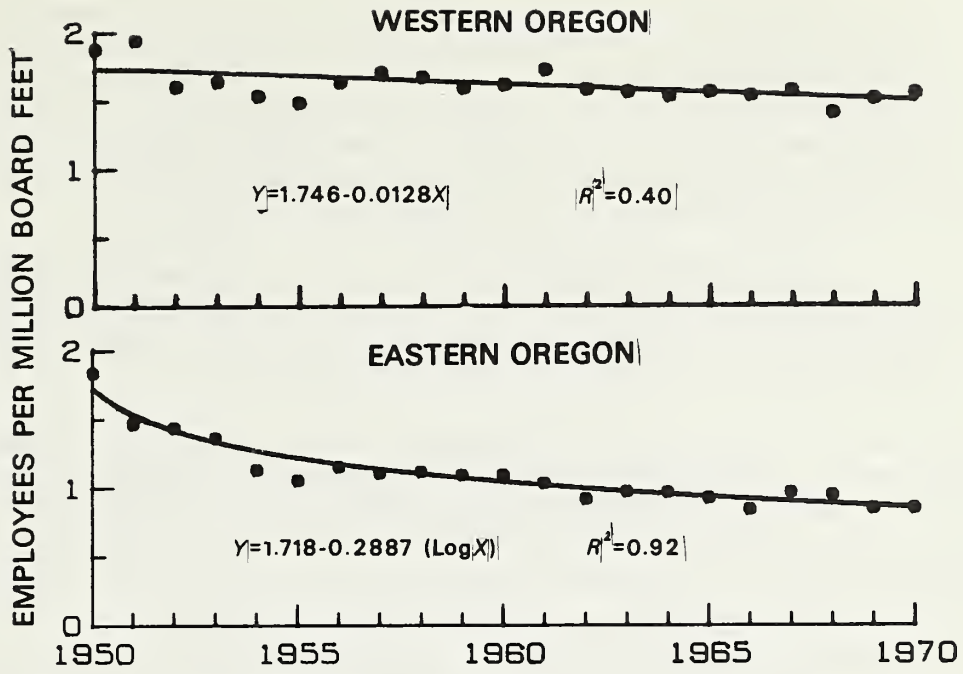



*Figure 3.--Average annual employment in logging (SIC 2411) per million board feet of wood harvested in Oregon by State area, 1950-70.*

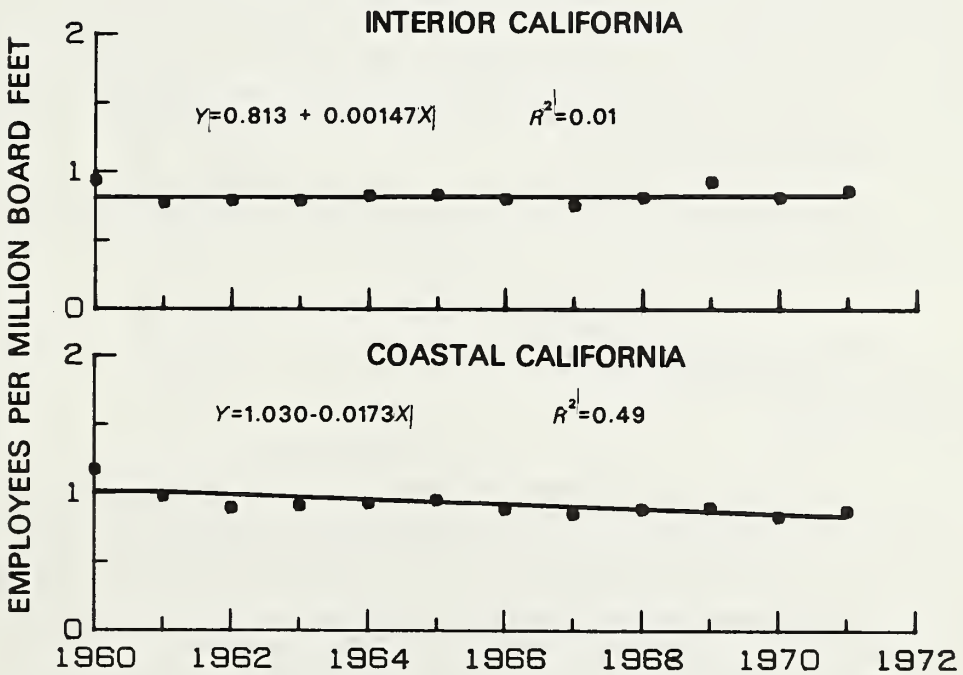



*Figure 4.--Average annual employment in logging (SIC 2411) per million board feet of wood harvested in California by State area, 1960-71.*

The linear relationship of declining employment per unit harvest in western Washington and eastern Washington cannot continue indefinitely. If it did, the requirement for labor to harvest timber would approach zero in both parts of the State between the years 1995 and 2000. This example points up the limitations in extrapolating the recent rates of change in these ratios indefinitely into the future. Obviously, labor will continue to be a necessary and important factor in the log production process.

Figure 3 shows the average annual employment in logging in western Oregon and eastern Oregon per unit harvest. The data for the 1950-70 period indicate slight declines in employment per unit harvest. The level of employment per unit harvest is less than in western Washington.

The data for eastern Oregon suggest the decline in logging employment per unit harvest is leveling off. Eastern Oregon logging employment ratios reached lower levels than western Oregon or Washington. Over the years, the present technology has been introduced and perhaps some temporary practical lower limit is being reached in the amount of employment required for log production.

Figure 4 shows the average annual employment per unit harvest in both interior and coastal California for 1960-71. The data show that, in both areas, logging employment per unit harvest has been lower than in Washington and Oregon.

Statistical analysis of the data for interior California reveals a very weak relationship between logging employment per unit harvest and time during the 1960-71 period. The fact that the ratios have not changed much over time is as useful as would be a changing trend in the ratio data. It indicates that the average value of $Y$, employees per unit harvest, is as good an estimate as exists for the period.

For coastal California, logging employment per unit harvest has declined only slightly since 1960.

## Sawmill and planing mill manpower requirements per unit wood consumption decline

The average annual employment in sawmills and planing mills per million board feet (log scale) of wood consumption has been declining on the Pacific coast over the past two decades. The curves of manpower requirements per unit of wood consumption vary over time by State area (figs. 5-9). The levels of labor used per unit wood input are slightly higher in western Washington sawmills than in other State areas on the Pacific coast. Table 8 shows regression equations for other curve forms fitted to the Pacific coast sawmill and planing mill data by State area.

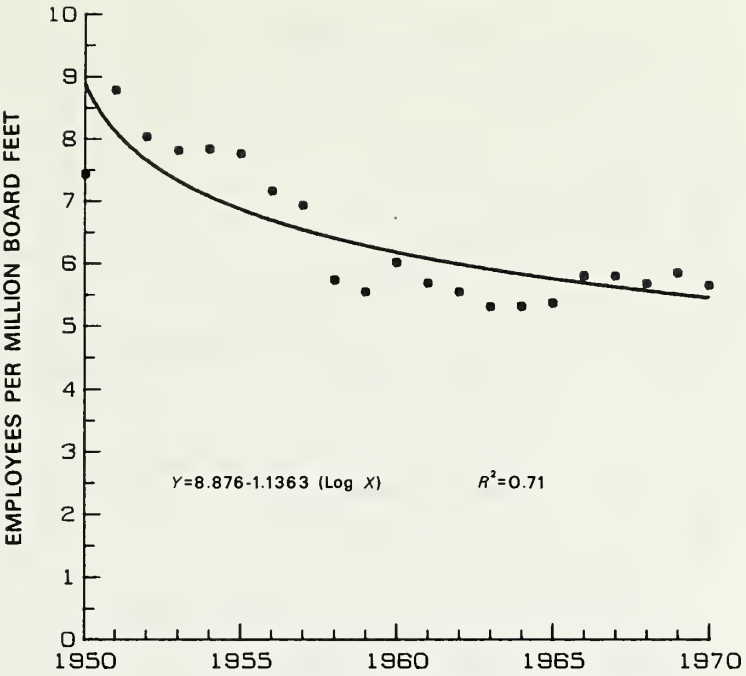



*Figure 5.--Average annual employment in sawmills and planing mills (SIC 2421) per million board feet of wood consumption in western Washington, 1950-70.*

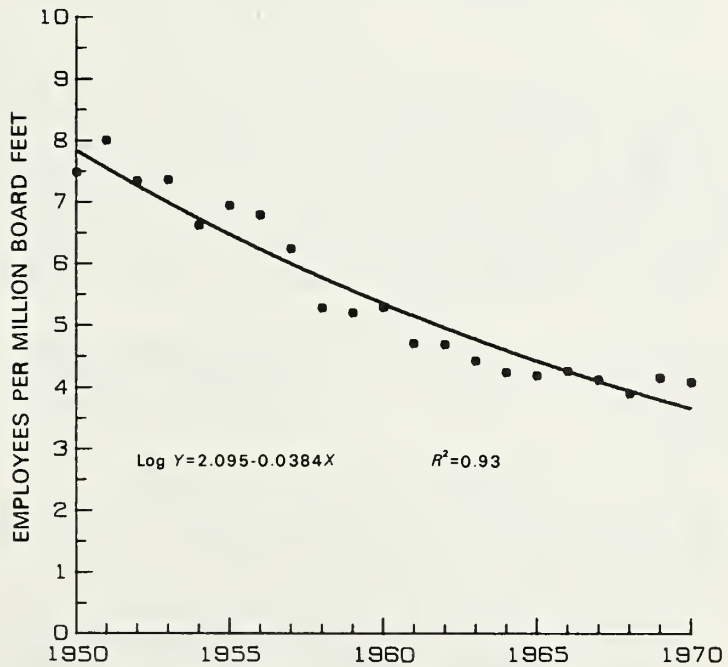



*Figure 6.--Average annual employment in sawmills and planing mills (SIC 2421) per million board feet of wood consumption in western Oregon, 1950-70.*

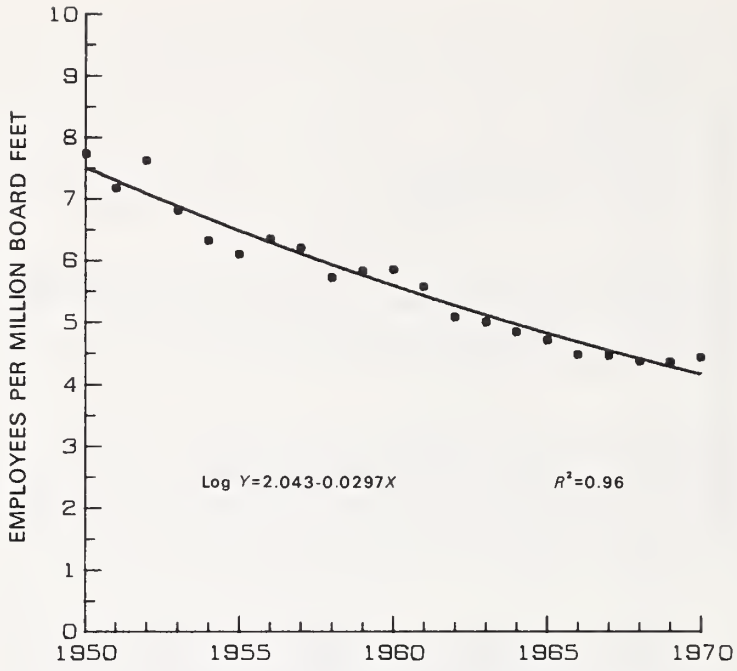



*Figure 7.--Average annual employment in sawmills and planing mills (SIC 2421) per million board feet of wood consumption in eastern Washington, 1950-70.*

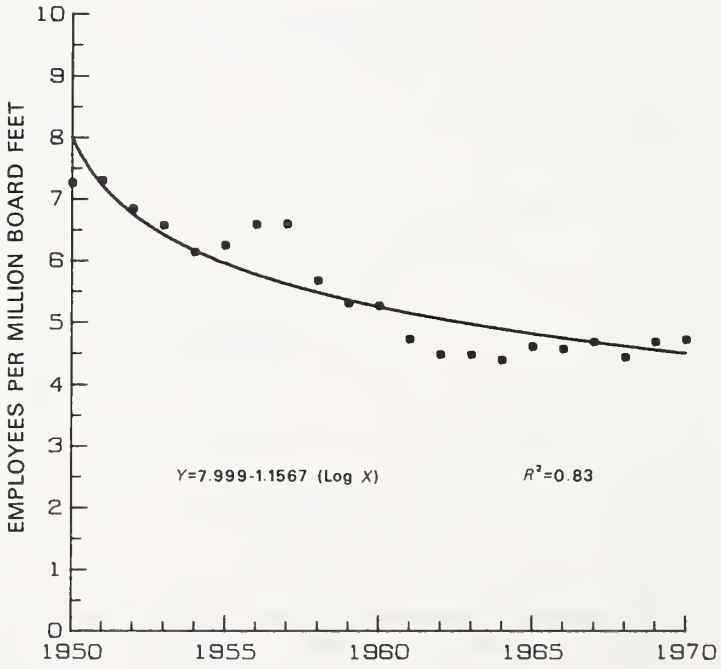



*Figure 8.--Average annual employment in sawmills and planing mills (SIC 2421) per million board feet of wood consumption in eastern Oregon, 1950-70.*

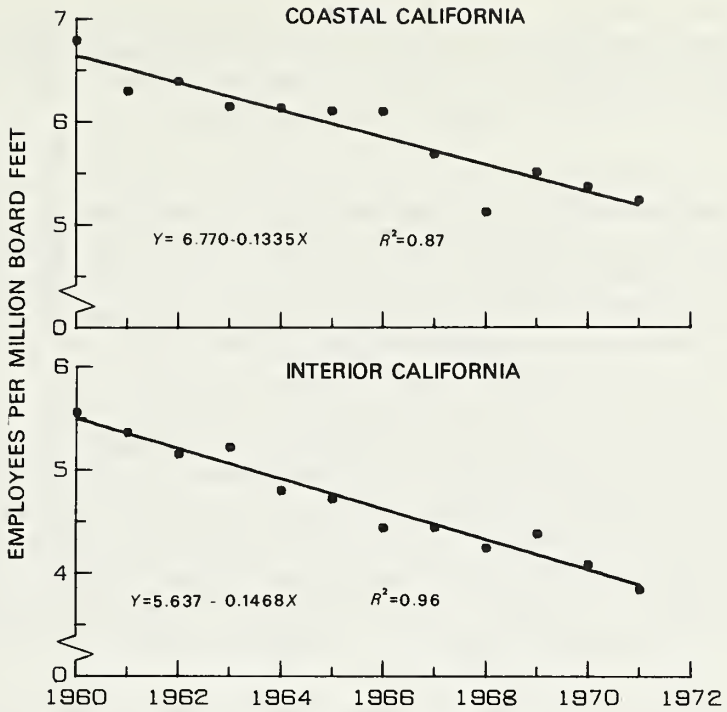



*Figure 9.--Average annual employment in sawmills and planing mills (SIC 2421) per million board feet of wood consumption in California, 1960-71.*

The changes in sawmill employment-wood consumption ratios cannot be attributed to changes in the duration of the workweek. Bureau of Labor Statistics data indicate that, between 1955 and 1971, average weekly hours of Washington State sawmill and planing mill production workers fluctuated with business conditions, but the trend was essentially level. In 1969, a low in average weekly hours of 37.2 was recorded; and in 1971, a peak of 39.6 hours was recorded. Data for Oregon and California are not available.

Figure 5 shows that the decline in the western Washington sawmill and planing mill employment-consumption ratios in the 1950's began to level off in the 1960's. In fact, the ratios for 1966-70 are somewhat higher on the average than for 1960-65.

Regression analysis was conducted for sawmill and planing mill employment-wood consumption ratios in western Washington for several different curve forms. The curve form (fig. 5) is certainly reasonable from an economic standpoint and, with judgment, may be used as a predictor. Other curve forms are shown in table 8.

Figure 6 shows that, unlike western Washington, the western Oregon employment-wood consumption ratios for sawmills and planing mills declined throughout most of the 1950-70 period. Whereas sawmill and planing mill

manpower requirements in western Oregon have tended to be lower than in western Washington throughout the period, the continuing decline in western Oregon has made this difference more pronounced in late 1960's. Analysis indicates a strong relationship between the variables.

Figure 7 shows that sawmill and planing mill manpower requirements per unit wood input in eastern Washington have tended continuously downward over the last two decades. By 1970, the labor requirement per million board feet of wood consumption approached 4 man-years, a level experienced only in western Oregon and in interior California. The regression in figure 7 shows a strong relationship between the ratios and time.

Figure 8 shows that employment-wood consumption ratios for the sawmills and planing mills in eastern Oregon had a declining trend during the 1950's with an upward jog in the 1955-57 period; during the 1960's, the ratios leveled out. Eastern Oregon sawmill and planing mill manpower requirements tended to be somewhat lower than those in eastern Washington during the early 1950's, but by 1970 they were slightly higher. We do not know why the manpower requirements in these two areas are taking on slightly different forms over time.

Figure 9 shows the sawmill and planing mill manpower requirements per unit wood input for California. In California, the analysis of manpower requirements is limited to the 1960-71 period because of lack of employment data for earlier years. During the past decade, the sawmill manpower requirements related to wood input have been declining. The curve forms on both figures are linear, and regression analysis indicates a strong relationship between the variables.

The drop in sawmill and planing mill manpower requirements per unit wood input shown in figures 5 through 9 indicates that major forces have been working in this industry to reduce employment. These trends in manpower requirements suggest that future sawmill employment will tend to decline even if sawmill wood consumption remains stable.

### Veneer and plywood manpower requirements have rapidly declined

In Washington, Oregon, and California, the employment required per million board feet of wood consumed by veneer and plywood plants has been declining sharply. Even though manpower requirements have declined in all areas, Washington veneer and plywood plants require more manpower than those in Oregon and California. Plants in Washington along Puget Sound require substantially higher than average labor inputs. This area has many specialty panel plants which produce high density overlays and hardwood panels. This requires special handling by workers and longer than average press times during the manufacturing process. These mills also produce a high proportion of sanded panels, which increase the labor requirements.

Figure 10 shows that, in Washington, average annual employment in the veneer and plywood industry per million board feet of wood consumed dropped nearly 50 percent during the 1950-70 period. In Oregon, the employment per unit wood consumption in veneer and plywood plants dropped 48 percent during the 1950-70 period (fig. 10).

The employment data used in the analysis of California requirements (fig. 11), excluded hardwood panel and prefinishing plants in Los Angeles, Orange, Riverside, San Bernardino, and Alameda Counties. Plant employment in these counties is not related to softwood consumption. During the 1960-71 period, manpower requirements related to wood consumption in softwood veneer and plywood plants dropped 28 percent.

The average weekly hours of production workers in the veneer and plywood industry in Oregon tended to be slightly higher in the mid-1960's than in the mid-1950's, according to Bureau of Labor Statistics 1972 data. In 1956, average weekly hours were 40.7. In 1968, they peaked at 43.5; and in 1971, they were 41.6. Apparently, average weekly hours fluctuate somewhat with business conditions, but the changes are not large enough to significantly affect the employment-wood consumption ratios.

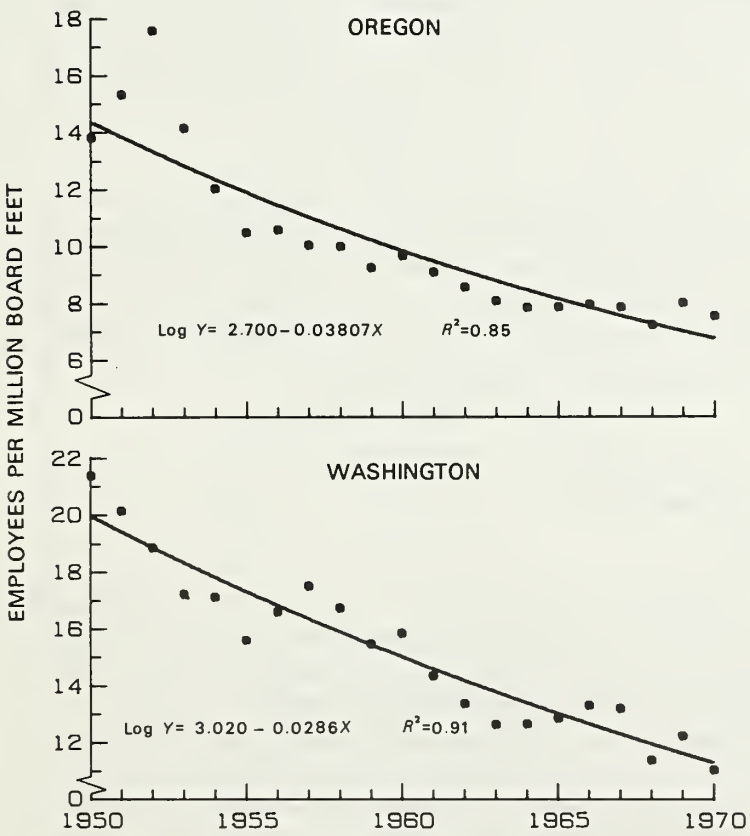



*Figure 10.--Average annual employment in veneer and plywood plants (SIC 2432) per million board feet of wood consumption in Oregon and Washington, 1950-70.*

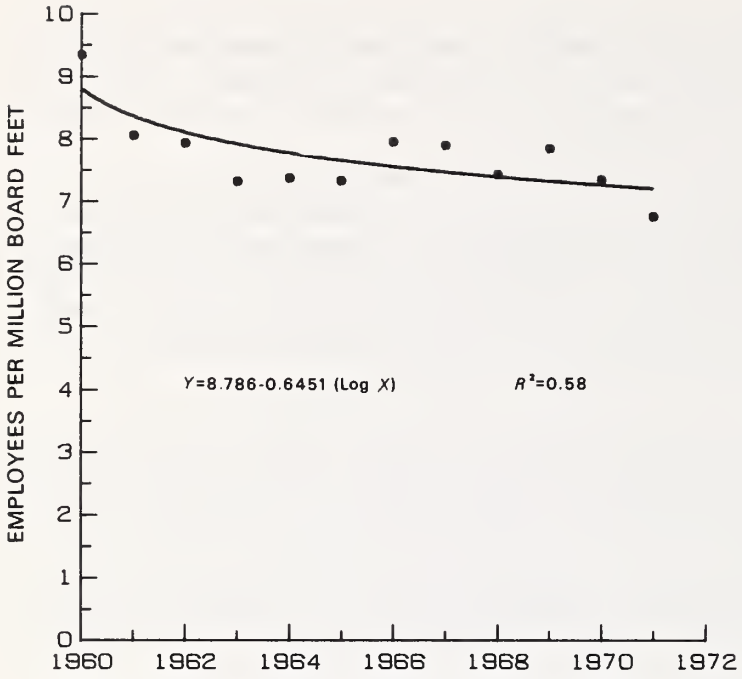



*Figure 11.--Average annual employment in veneer and plywood plants (SIC 2432) per million board feet of wood consumed in California, 1960-71.*

The employment-consumption ratios in the veneer and plywood industry are influenced by the change in the mix of products. There has been a shift toward production of sheathing materials rather than sanded panels. The manpower requirements are substantially less for producing sheathing, and this has tended to reduce the employment-wood consumption ratios in areas where sanded paneling production was previously high.

The closing of older, labor-intensive plants and the building of new plants which tend to produce a high proportion of sheathing have the effect of lowering the employment-wood consumption ratios over time. This has been a factor in Washington, for example. In California, the change in the number of firms operating and the number of green veneer plants relative to layup plants could influence the employment-consumption ratio.

## Employment per unit wood consumption declines in the pulp, paper, paperboard, and building paper industries

On the Pacific coast, the total employment per unit of wood consumption in the paper and allied products industry (SIC 26) has been declining. This relationship for the entire paper and allied products industry has commonly been used in preparing employment impacts related to timber output in resource studies for State areas. We recognize that there can be problems with this total employment method because employment in manufacture of converted paper and paperboard products and paperboard containers and boxes is not necessarily related to wood consumption in the same State area.

In California, for example, most of the total paper and allied products employment is in secondary, market-oriented activities that are little affected by wood consumption (Oswald 1970). These activities utilize purchased paper and pulp. Thus, other methods are needed to project employment for the market-oriented industry segments, especially when they are heavily concentrated in one geographic area.

In this study, we have examined not only the total employment-wood consumption relationships for the pulp, paper, and allied products industry but also the primary manufacturing-wood consumption relationships. Even this latter relationship presents problems, for it aggregates different manufacturing processes and some firms use purchased pulp instead of pulpwood as inputs. However, it does give a much firmer basis for estimated employment with respect to wood consumption than use of the entire paper and allied products sector, and it leaves the market-oriented employment to be treated in a different fashion.

Pulpwood consumption in this study includes both roundwood pulpwood and primary manufacturing residue (i.e., chips and sawdust). In California, some of the pulpwood which is consumed includes recycled waste lumber from such things as pallets, crates, etc.

Figure 12 shows two plotted sets of data and curves for the paper and allied products industry in the State of Washington. The top curve shows the

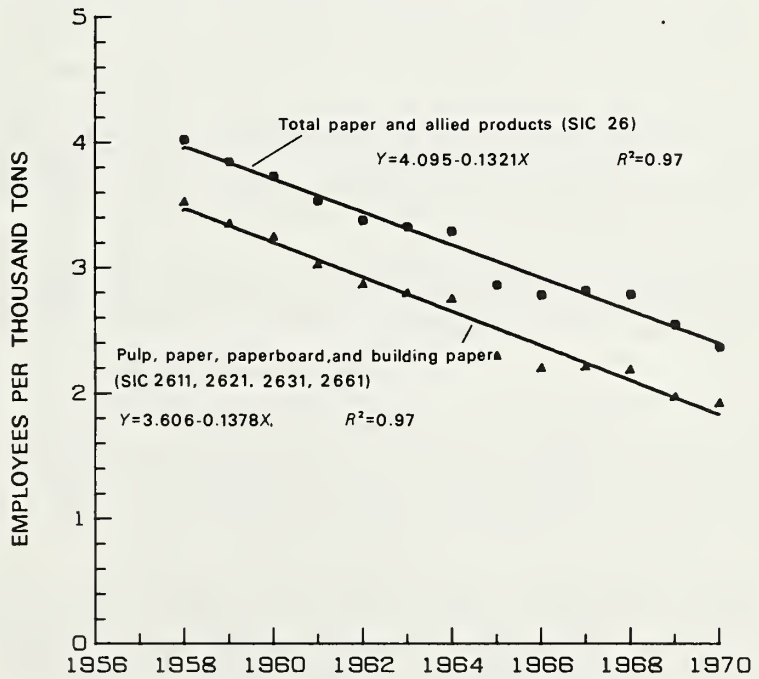



*Figure 12.--Average annual employment in the total paper and allied products industry and in the pulp, paper, paperboard, and building paper industry segments per thousand tons of pulpwood consumed in Washington, 1958-70.*

relationship of the total employment in the industry (SIC 26) to pulpwood consumption for the 1958-70 period. The lower curve shows the relationship for the more direct wood-consuming segments of the industry--pulp, paper, paperboard, and building paper (SIC 2611, 2621, 2631, 2661). Both curves decline sharply during the period, indicating that changes in manufacturing labor requirements have taken place. The pulp, paper, paperboard, and building paper curve is roughly parallel to the total paper and allied products curve, and analysis reveals a strong relationship between the ratios and time. The parallel nature of the two curves occurs primarily because wood-consumption-related employment accounts for most of the total paper and allied products employment. Also, secondary-manufacturing employment has tended to increase at the same time wood consumption in the primary sector has increased.

Since most of the employment in total paper and allied products in Washington is in the primary manufacturing processes, the practice of relating all employment to pulpwood consumption seems acceptable. However, we must point out that secondary manufacturing employment is not directly related to local pulpwood consumption. Use of such an extrapolated trend of ratios would not be correct if, for example, it were tied to declining or static consumption when rises in secondary employment could be anticipated.

In Washington, the employment-pulpwood consumption ratios dropped about 45 percent between 1958 and 1970 for the pulp, paper, paperboard, and building paper industry segments. A continuation of the current trend in the ratio would result in a zero labor requirement in the early 1980's. It is obvious that the recent trend will change, for even though the industry is highly mechanized, labor will continue to be needed for the manufacturing process. One clue to the level at which the employment-consumption ratios will level off may come from examining the ratios for individual new, efficient plants as an indicator of what the industry will tend to be like.

Figure 13 shows the total Oregon pulp and paper employment-wood consumption relationship for the 1958-70 period; it also shows the ratios of pulp, paper, paperboard, and building paper employment to wood consumption for the same period. For both curves, analysis indicates a strong relationship between variables. A linear curve describes the pulp, paper, paperboard, and building paper ratios over time equally well from a statistical standpoint. The employment data for both curves in figure 13 excludes the hardboard industry employment which was included in the original data reported under covered employment for the 1958-63 period.

The problem associated with using the total paper and allied products curve as a predictor is apparent for Oregon, because secondary manufacturing employment is not related directly to local pulpwood consumption. The employment in the industrial sectors, converted paper, paperboard products, paperboard containers, and boxes, has not grown relative to the increase in wood consumption in the State. In Oregon, the percentage of total employment which is secondary and market oriented is larger than in Washington.

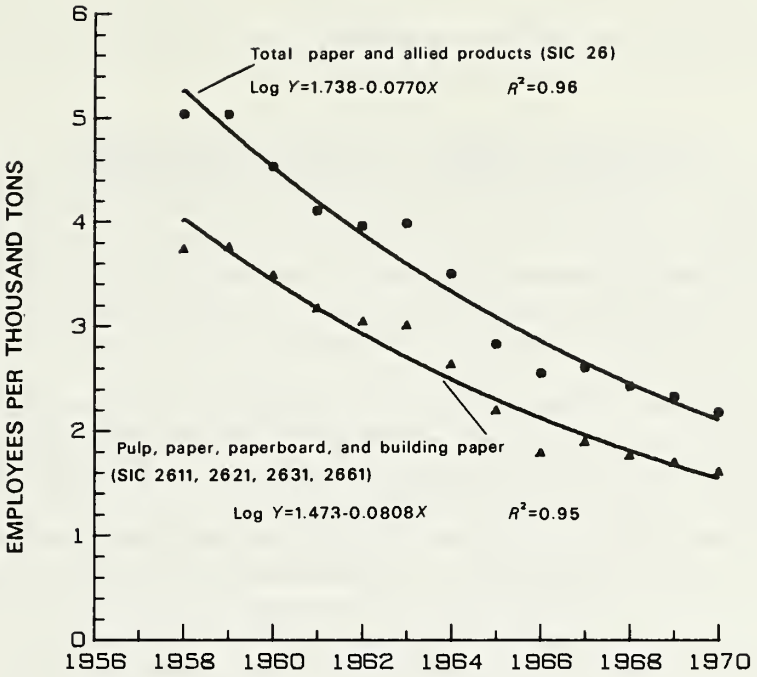



*Figure 13.--Average annual employment in the total paper and allied products industry and in the pulp, paper, paperboard, and building paper segments per thousand tons of pulpwood consumed in Oregon, 1958-70. (Adjusted for hardboard reclassification.)*

The larger the secondary sector relative to the primary sector when wood consumption is increasing, the more pronounced the problem of curve convergence will be. The two curves in figure 13 tend to converge. Thus, the extrapolation and use of the total paper and allied products employment-wood consumption curve would tend to underestimate total employment in future time periods. The same erroneous assumption based on the past, that paper products fabrication depends on local sources of wood, is inherent in this technique.

In California, the relationship between total paper and allied products employment and pulpwood consumption is of no practical use because most of the employment in this sector is not related to pulpwood consumption. Consequently, no curve of this relationship is shown. The top curve in figure 14 shows the average annual employment in the pulp, paperboard, and building paper industry (SIC 2611, 2621, 2631, 2661) per thousand tons of pulpwood consumed during the 1960-71 period. Analysis indicates a strong relationship between the variables. In California, a number of employees are working in mills which use purchased woodpulp from outside California and thus are not directly related to the increasing local pulpwood consumption; their inclusion affects the data and the curve. In fact, in California, only 7 of the 33 pulp, paper, paperboard, and building paper

mills in this category consumed local pulpwood. Consequently, this upper curve is unsuitable and would be misleading for projecting employment in California by employment-wood consumption ratios.

For a more realistic relationship between employment and pulpwood consumption, employment for each wood-consuming mill was identified for the 1960-71 period. The lower curve in figure 14 shows the average annual employment-consumption ratios for these selected mills. Analysis indicates a strong relationship between these ratios and time. This lower curve, based on only the mills that consumed wood, would be suitable for extrapolation of employment associated with wood consumption.

Some readers may be disappointed that we have not presented a method or equations for projection of secondary employment in the forest products industries. However, the thrust of this paper was to deal with those sectors whose employment levels are directly responsive to changes in "local" raw material supplies. There are several simple approaches for those who wish to make employment projections for the secondary forest products industries. One approach is to investigate total employment over time in any given secondary industry sector. If a definite trend can be identified, it can be extrapolated as a means of projection. This method is useful only for short periods of time since it does not use causal factors such as market growth for prediction. The trends in total employment by industry sector presented in the next section of this paper should be helpful to those interested in this type of approach.

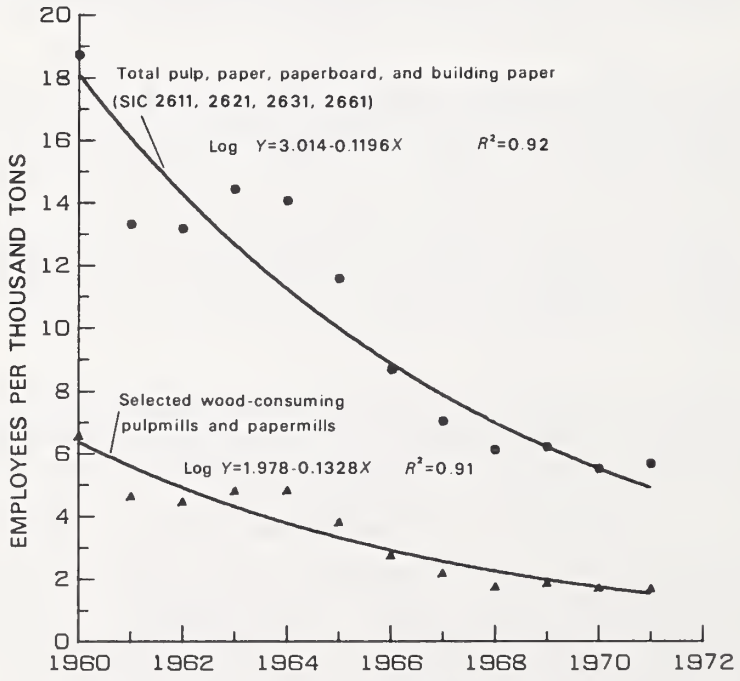



*Figure 14.--Average annual employment in the pulp, paper, paperboard, and building paper industry segments of the paper and allied products industry and in selected pulpmills and papermills per thousand tons of wood consumed in California, 1960-71.*

## TRENDS IN TOTAL EMPLOYMENT

This section presents the recent trends in total employment in the forest industries of the Pacific coast. For the wood-consuming industry sectors, these trends reflect both wood input-product output and labor requirements per unit of input or output. The contribution of wood consumption or production levels and labor requirements to employment trends can usually be assessed for individual industrial categories for which physical production or raw material consumption levels are identifiable. For industries where the quantity of physical outputs or material inputs is unknown, it is difficult to tell what is contributing to the trends in employment. As a generalization, however, increasing trends in employment are due to increasing production levels; decreasing trends can be due to decreasing production, decreasing labor requirements, or both.

Employment trends which are aggregates for several industrial sectors cannot be attributed directly to either labor requirement or production levels until the components of the aggregate are analyzed separately. Such aggregate trends lend themselves more readily to observation than to analysis.

### Total forest products industries employment has been stable

From 1950 to 1971, employment in the forest industries of the Pacific coast (Washington, Oregon, and California) has been fairly stable, varying only about 6 percent in either direction from the 228,000 average for the entire period. Employment in these industries peaked in 1951 and again in 1955 at 242,000. In 1961, a recession year for the Nation's economy, employment dipped to 213,000 (fig. 15). The fluctuations in employment are generally reflective of fluctuations in output in response to market demand and general economic conditions.

The forest industrial employment trend for California during the 1950's and 1960's was unlike the parallel Oregon and Washington trends. In California, there was a rising trend in the 1950's, and again in the 1960's following the 1960-61 recession. Employment peaked near the end of each decade. In both Oregon and Washington, employment peaked in 1951 and trended downward throughout the 1950's, becoming fairly stable during most of the 1960's.

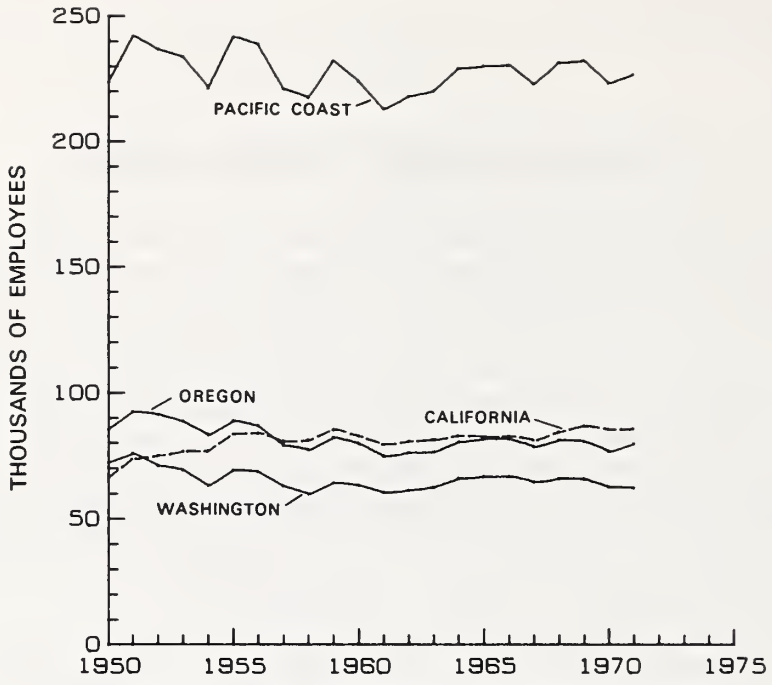



*Figure 15.--Total average annual employment in the lumber and wood products and paper and allied products industries on the Pacific coast, 1950-71.*

## Employment has declined in lumber and wood products manufacture

Employment in the manufacture of lumber and wood products (SIC 24) on the Pacific coast has been declining over the last two decades. From a peak of 203,000 in 1951, employment trended sharply downward during the remainder of the 1950's; employment during that period was characterized by sharp fluctuations around the trend (fig. 16). During the 1960's, the employment trend leveled considerably and the cyclical fluctuations became less pronounced. The fluctuations in employment are generally reflective of fluctuations in output in response to market demands.

The employment trends in Oregon and Washington are quite similar; in both States, employment in lumber and wood products peaked in 1951, reached a low point in 1961, and approached a stable level during the remainder of the 1960's. In California, employment peaked in 1955, but thereafter the trend paralleled those of Oregon and Washington.

Although lumber and wood products represents one major industrial sector, it is an aggregation of many distinctly different and separate manufacturing activities, including extraction of raw material (logging), manufacture of commodities (lumber and plywood), and remanufacture (millwork, prefabrication, etc.). Consequently, the trends in the overall sector represent a merging of the trends in all the individual subsectors.

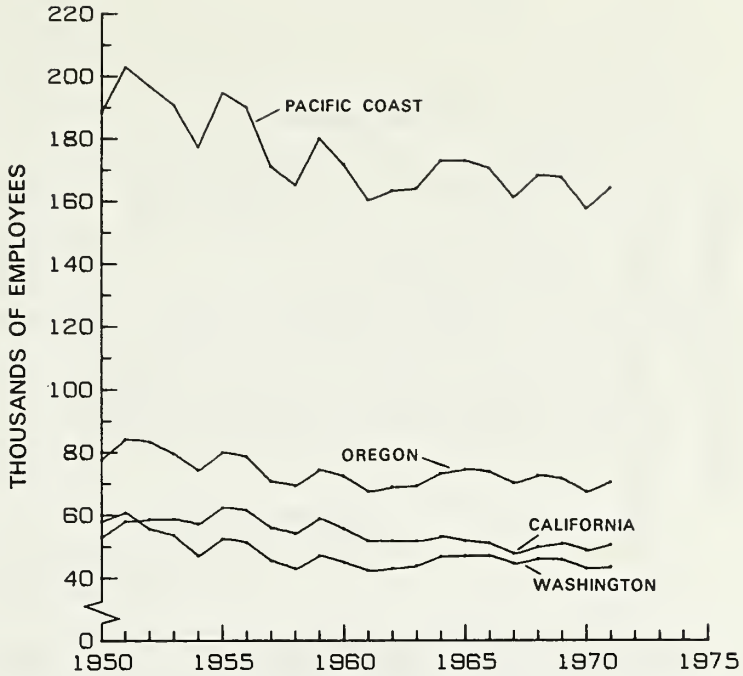



*Figure 16.-- Average annual employment in the lumber and wood products industry on the Pacific coast by State, 1950-71.*

## Logging employment trends vary from area to area

Distinctly different trends in logging employment are apparent between the subareas in each State. For the Pacific coast as a whole, grouping of western or coastal areas apart from eastern or interior areas does tend to combine similar producing areas which have some products and markets in common.

In western Oregon, logging employment has trended downward throughout the last two decades. By 1971, employment had declined over 30 percent from its 1951 peak. The steep downward trend in the 1950's reflects primarily the downward trend in timber harvest during that period. However, during the 1960's, the harvest fluctuated around a stable base but employment continued to decline due to the gradual downward trend in labor requirement per unit harvest (fig. 17).

In western Washington, the downward trend in logging employment of the 1950's reversed in the 1960's. During the former period, the downward trend resulted from declines in both timber harvest and labor requirements; in the 1960's, a rapidly increasing harvest trend resulted in substantial increases in logging employment, even though labor requirements in the area continued the downward trend of the 1950's.

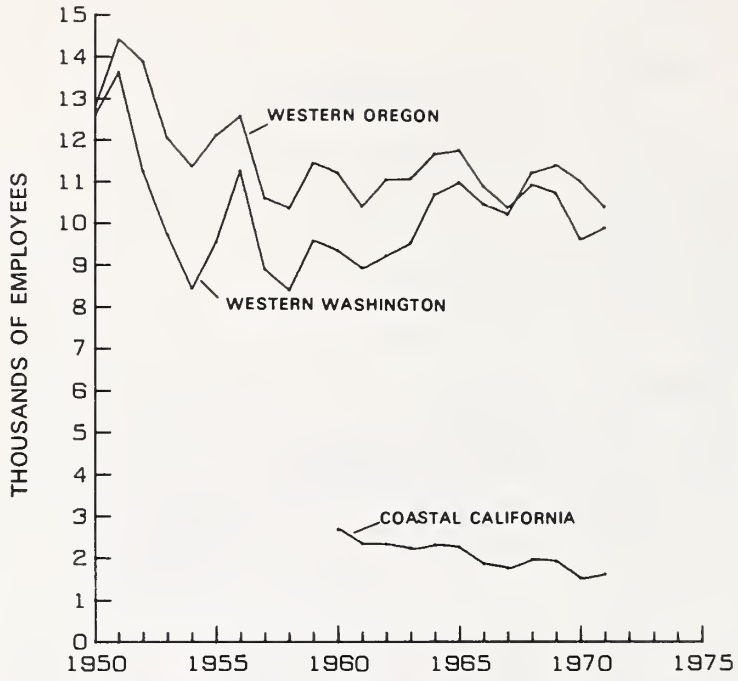



*Figure 17.--Average annual employment in logging in western Washington, western Oregon, and coastal California, 1950-71.*

Logging employment in coastal California declined 45 percent from 1960 to 1970. Declining harvests as well as declining labor requirements contributed to the trend.

In contrast to the complex trends and sharp fluctuations in logging employment in the western areas of the States, the eastern or interior areas have experienced relatively stable employment (fig. 18). In interior California, the harvest remained stable during the 1960's as did labor requirements, resulting in an essentially stable employment situation throughout the decade. In eastern Oregon, increasing harvests were offset by decreasing labor requirements during the 1950's, and employment was stable. The trend of increasing harvests continued in the 1960's, but labor requirements diminished at a slower rate, no longer offsetting the employment effect of increasing harvests; logging employment consequently increased throughout much of the 1960's. Logging employment in eastern Washington increased with increasing harvests in the 1950's but stabilized in the 1960's due to the offsetting trends of increasing harvests and decreasing manpower requirements.

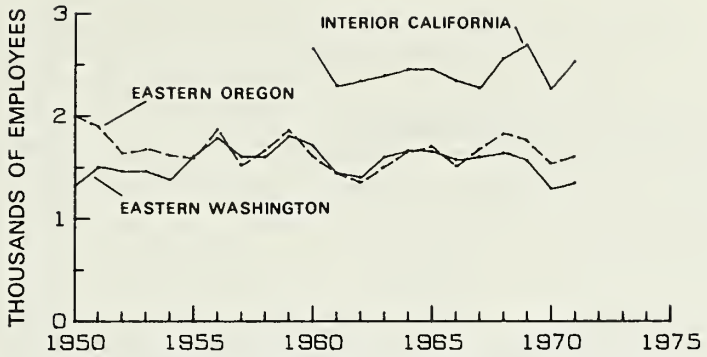



*Figure 18.--Average annual employment in logging in eastern Washington, eastern Oregon, and Interior California, 1950-71.*

## Employment in the manufacture of lumber has declined

Employment in sawmills and planing mills has declined substantially in Oregon, Washington, and California in the last two decades. Until recently, this manufacturing activity provided more employment than any other wood manufacturing activity in each of the three States. This is no longer true in Oregon where veneer and plywood plants are now the leading employers.

In western Oregon, employment in sawmills and planing mills trended sharply downward throughout the 1950's; during the 1960's the downward trend moderated (fig. 19). By 1970 employment in this manufacturing activity had fallen 60 percent from the 1950 level. The steep downward trend in the 1950's resulted from declining output and a 30-percent decline in labor requirements. During the 1960's, the output was fairly stable, and most of the employment decline was attributable to a moderate decline in labor requirements.

In western Washington, employment in sawmills and planing mills fell from 20,000 in 1950 to 11,400 in 1961 due to declining production and rapidly diminishing labor requirements. During the 1960's, employment stabilized as a result of stable trends in both output and labor requirements.

Coastal California employment in sawmills and planing mills declined about 25 percent during the 1960's, all of which is attributable to the diminishing requirement for labor in the lumber manufacturing process.

Except for the 1950-55 period, the employment trend in sawmills and planing mills in eastern Oregon is similar to the western Oregon pattern. The 30-percent decline in employment from 1955 to 1961 was due primarily to a 25-percent decline in labor requirements during that brief period (fig. 20). However, during the 1960's, employment declined little; during this latter period, employment requirements stabilized but production declined slightly.

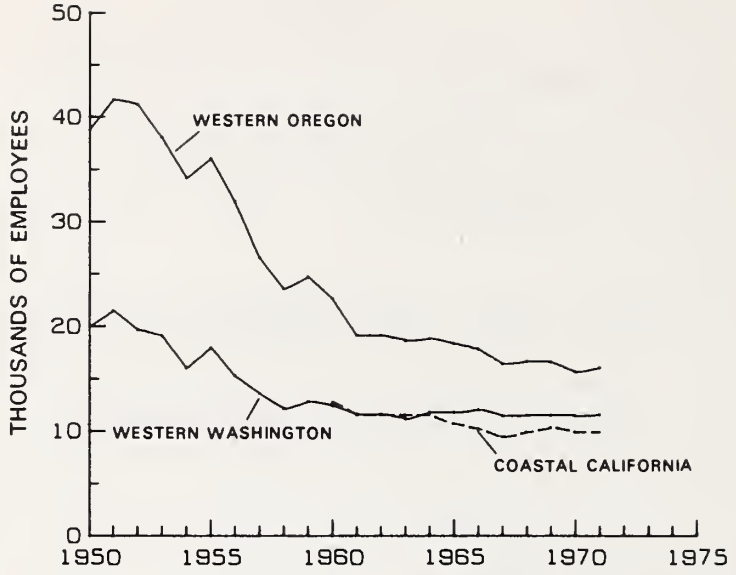



*Figure 19.--Average annual employment in sawmills and planing mills in western Washington, western Oregon, and coastal California, 1950-71.*

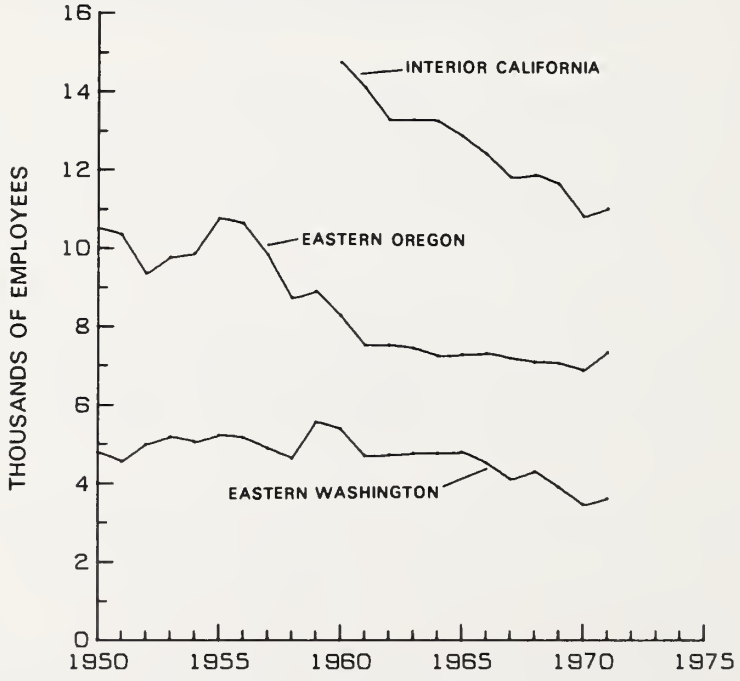



*Figure 20.--Average annual employment in sawmills and planing mills in eastern Washington, eastern Oregon, and interior California, 1950-71.*

In eastern Washington, there has been a rather continuous decline over the last two decades in the requirement for labor in the manufacture of lumber. Increasing production during the 1950's offset the diminishing labor requirements, and employment was fairly stable. During the early 1960's, the output continued to increase and employment remained stable, although somewhat lower than the levels of the previous decade. However, after 1965, a downward employment trend developed in response to a reversal in the trend of product output.

Interior California's employment in lumber manufacturing has trended sharply downward in the last decade, dropping 27 percent from 1960 to 1970. This area experienced the most precipitous employment decline in lumber manufacture in the 1960's of any of the half-State areas (figs. 19, 20). Production during this period has been stable; all the employment decline is attributable to decreasing manpower requirements.

## Employment in the manufacture of veneer and plywood has decreased in recent years

Until recent years the employment trend in Oregon's plywood industry was distinct from those of Washington and California (fig. 21). Oregon's employment more than quadrupled from 1950 to 1965 when this important industry employed 27,629 persons. During that expansion period, production increased eightfold; however, manpower requirements dropped almost 50

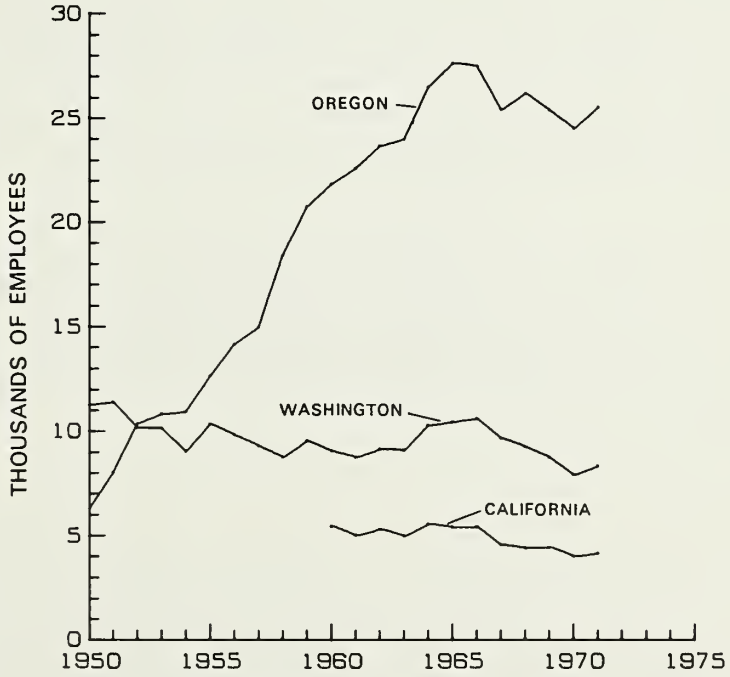



*Figure 21.--Average annual employment in veneer and plywood plants in Washington, Oregon, and California, 1950-71.*

percent during the same period. The decline in employment since 1965 reflects fluctuations in production and a continuation in the downward trend in labor requirements.

The softwood plywood industry pioneered in Washington. Employment in the then-mature Washington plywood industry peaked at 11,395 in 1951, then declined through the late 1950's due to decreasing labor requirements. Increasing production in the early 1960's more than offset the continuing trend of decreasing labor requirements, and employment increased to 10,612 in 1966; as production stabilized in the latter part of the 1960's, the continuing downward trend in labor requirements again was reflected in declining employment.

In California, the manpower requirements for plywood manufacture have been relatively stable throughout the 1960's. Employment in this industry was stable during the 1960-66 period but declined with lower production in the latter part of the decade.

## Employment in other lumber and wood products industry subsectors has increased

Employment in subsectors of the lumber and wood products industry other than logging, lumber, and veneer and plywood manufacture has generally been stable or increased during the 1960's. For these subsectors as a group, employment increased from 30,431 in 1960 to 39,315 in 1971, an increase of 29 percent. Included in this grouping of industries are manufacturers of prefabricated wooden building and structural members, wooden container manufacturers, wood preservation firms, hardwood dimension and special product sawmills, manufacturers of miscellaneous wood products including hardboard and particle board, and millwork plants. Figure 22 shows employment trends for each of these industrial subsectors.

Unlike the logging, lumber, and plywood sectors, each of which has one identifiable product, these subsectors are made up of manufacturers of many different products. Consequently, there is no common unit of raw material input or physical output within each sector, and the contributions of labor requirements and production levels to the employment trends are difficult to assess.

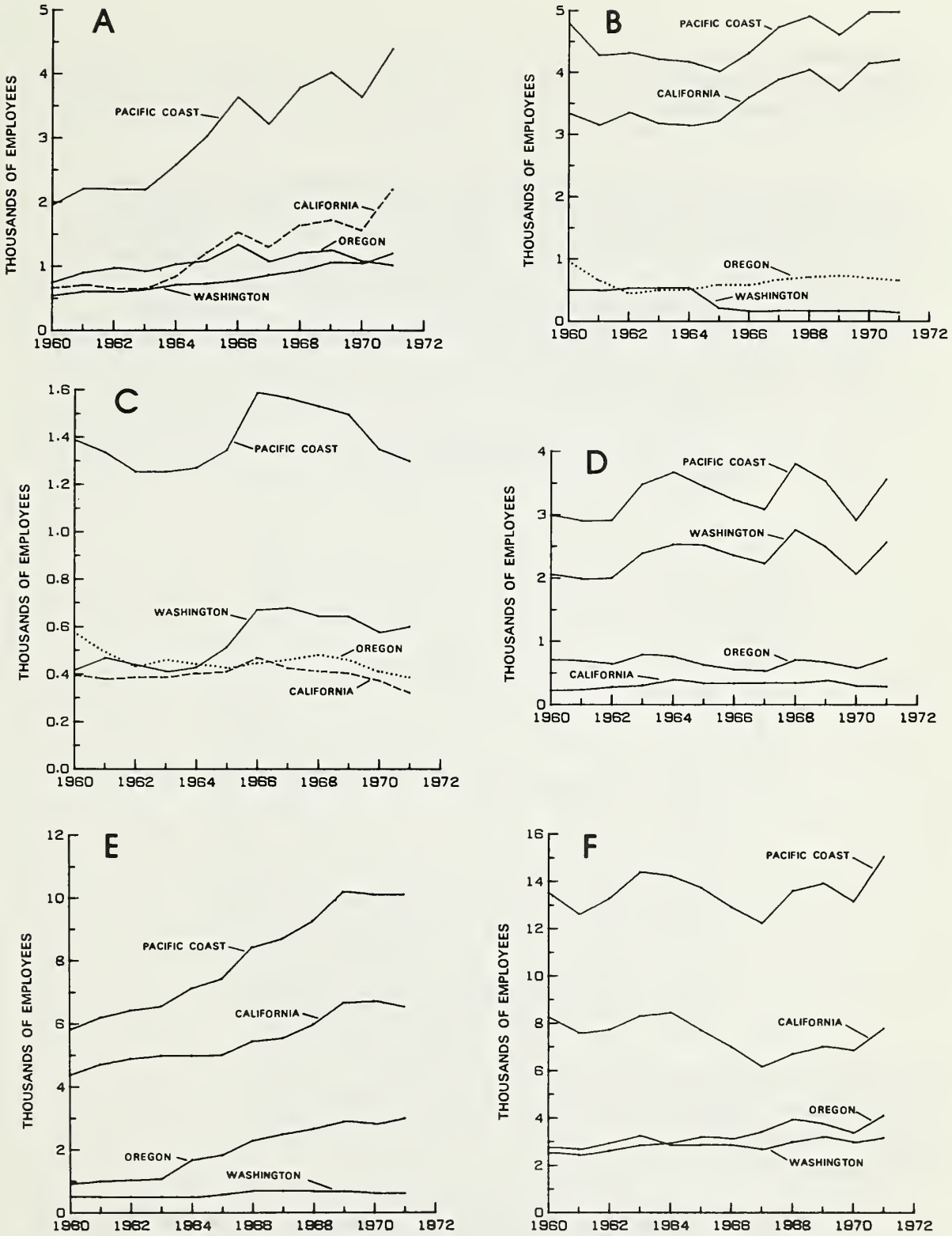



*Figure 22.--Average annual employment in Washington, Oregon, and California, 1960-71, in:* A, *prefabricated wooden building and structural member manufacturing plants;* B, *wooden container manufacturing plants;* C, *wood preservation firms;* D, *hardwood dimension and flooring mills and special product sawmills;* E, *miscellaneous wood products manufacturing plants; and* F, *millwork plants.*

## Employment in paper and allied products industry is on long upward trend

Between 1950 and 1971, employment in the paper and allied products industry (SIC 26) on the Pacific coast increased 90 percent. The upward trend in employment was almost continuous throughout that timespan, in each of the three States as well as for the Pacific coast (fig. 23). California, which has had the most rapid rate of growth, had 35,471 persons or 56 percent of the Pacific coast employment in this industry in 1971. Washington accounted for 29 percent (18,071 employees) of the total, and Oregon had the remaining 15 percent (9,424 employees).

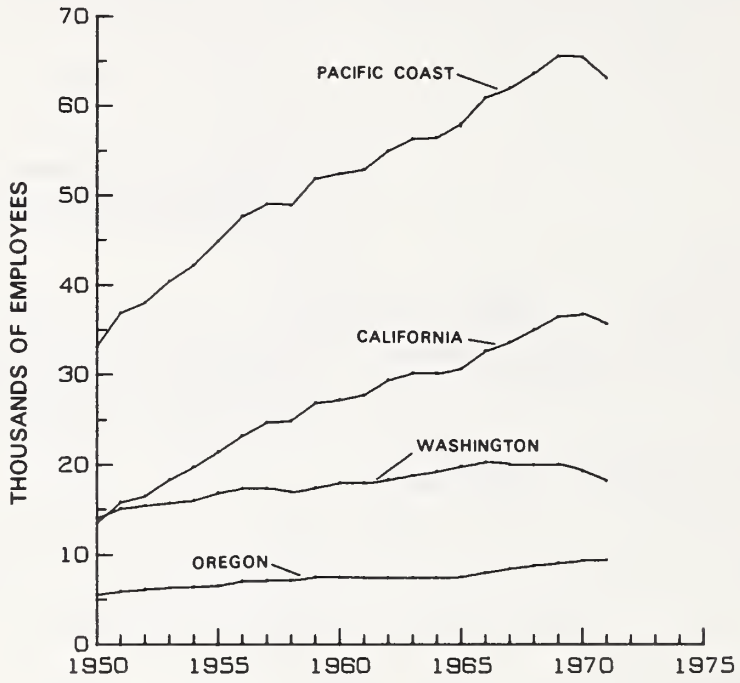



*Figure 23.--Average annual employment in the paper and allied products industry in Washington, Oregon, and California, 1950-71.*

## Pulp, paper, paperboard, and building paper industries employment increased during the 1960's

The pulp, paper, paperboard, and building paper sectors (SIC 2611, 2621, 2631, 2661) are the primary processing subsectors of the paper and allied products industry. Many of the manufacturing facilities have pulping equipment and thus consume pulpwood (in some form). Such firms depend

on local and regional forest resources. However, many of the manufacturing facilities included in this group (SIC 2621, 2631, and 2661) use purchased or transferred pulp instead of pulpwood. This is especially true in California where four-fifths of the establishments included do not use pulpwood.

Employment in these industries on the Pacific coast increased from 27,359 in 1960 to a peak of 31,004 in 1968; after 1968, a combination of a recessionary period and some labor disputes resulted in a downturn in employment (fig. 24). Washington experienced rather stable employment in the primary paper industries during the 1960's, a result of two offsetting trends: rising wood consumption and falling labor requirements. Oregon, like Washington, has experienced countering trends of rapidly increasing pulpwood consumption and rapidly decreasing labor requirements in primary pulp, paper, paperboard, and building paper manufacturing in the 1960's. The rate of increase of consumption, however, has exceeded the rate of decrease in labor requirements; consequently, Oregon experienced a 21-percent increase in employment in these industries from 1960 to 1970.

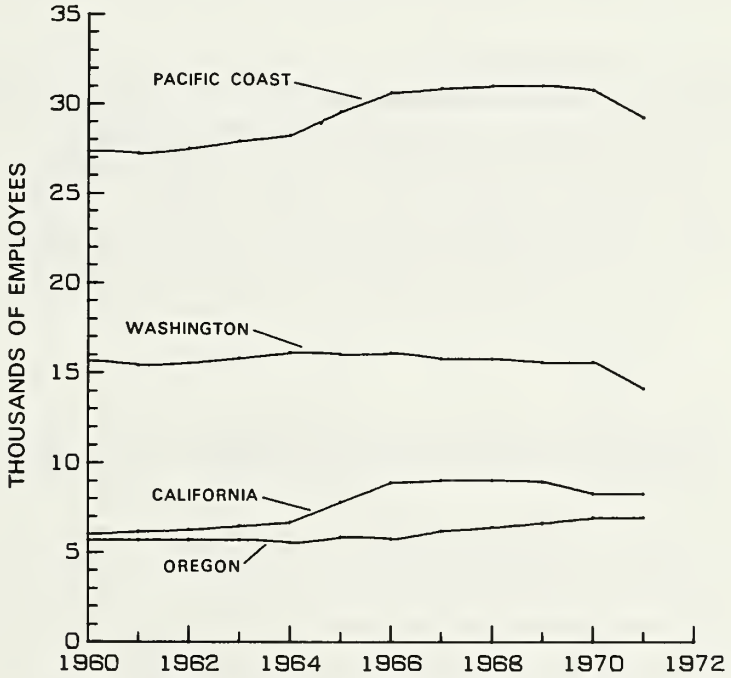



*Figure 24.--Average annual employment in pulp, paper, paperboard, and building paper plants in Washington, Oregon, and California, 1960-71.*

In California, employment in these primary paper industries trended upward until the late 1960's. In the pulpwood-consuming element of this industrial sector, wood consumption quadrupled during the 1960-71 period as the number of plants doubled. However, employment in these wood-using plants increased only 24 percent, because labor requirements decreased.

During this same period, employment in the nonpulpwood-consuming element of the primary paper industries experienced a more rapid growth rate--increasing 42 percent. These nonpulping paper and board mills account for 70 percent of California's primary paper manufacturing employment.

## Employment in fabricated paper product sectors increased during the 1960's

The two remaining major subsectors of the paper and allied products industry are remanufacturing activities concerned with the fabrication of products from paper and paperboard stock purchased or transferred from papermills or boardmills. These fabricating industries tend to be located near the markets for their product and are not dependent on a nearby supply of timber resources. Hence, the employment trends in these subsectors are related to local or regional market demand but not necessarily to local wood consumption patterns.

Employment in the manufacture of converted paper products (SIC 264) on the Pacific coast increased throughout the 1960's (fig. 25). California, which represents most of the market area for paper products on the Pacific coast, in 1971 accounted for 77 percent of the 16,360 persons employed in this sector. The growth in employment in this sector was concentrated in California and was undoubtedly related to that State's rapid population growth during the 1960's.

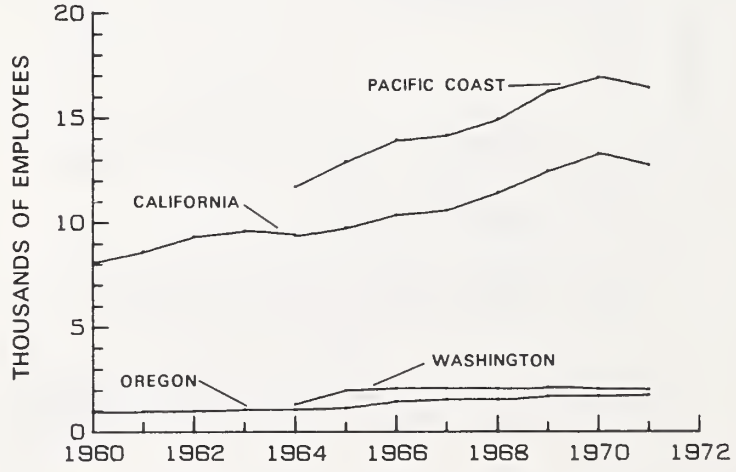



*Figure 25.--Average annual employment in converted paper and paperboard products manufacturing plants in Washington, Oregon, and California, 1950-71. (Data not available for Washington before 1964.)*

Trends and geographic patterns in employment in the paperboard container and box manufacturing industries (SIC 265) on the Pacific coast during the 1960's were similar to those for converted paper products (fig. 26). However, the concentration of employment in this sector in California was even greater. In 1971, 84 percent of the 17,491 persons employed in the Pacific coast paperboard container and box industries were located in California. The rate of employment growth in this sector was somewhat slower than was the rate for converted paper products.

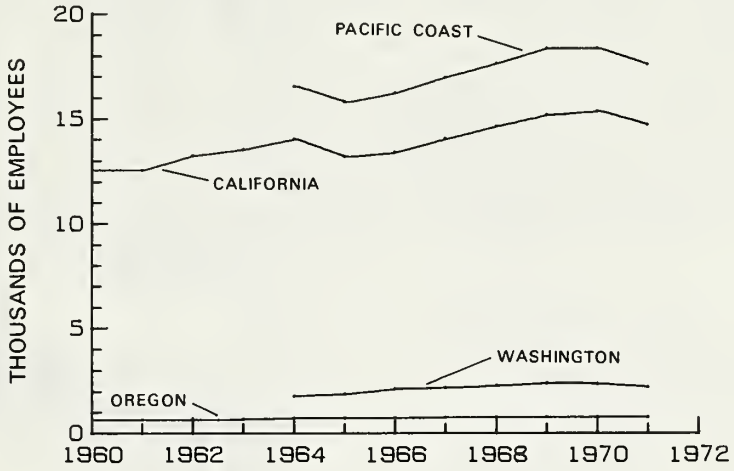



*Figure 26.--Average annual employment in paperboard container and box manufacturing plants in Washington, Oregon, and California, 1960-71. (Data not available for Washington before 1964.)*

## SEASONAL VARIATIONS IN EMPLOYMENT

In addition to the basic trends in employment which affect communities, the fluctuation in employment throughout the year also can have a major impact on the community's economy if it depends heavily on the fluctuating industry. Obviously, the worker employed in an industry with seasonal fluctuation directly feels the impact if he is unemployed for part of the year. The forest industries do have seasonal fluctuations, and forest-based communities have to live with this as a fact of life. Smith and Gedney (1965) documented the monthly variation in the forest products industry in Washington and Oregon for the 1957-61 period. In this section, we will discuss the seasonal fluctuation patterns for the Pacific coast for 1969-71 and compare them with those of the Smith-Gedney study. The fluctuations are presented in terms of plus or minus percentage variation from the average annual employment in an industry sector (such as logging). The percentage indicates the degree of variation, the greatest percent indicating the month of highest (+) or lowest (-) employment. The variations have not been adjusted for employment trends even though we recognize this has some influence on the results.

## Seasonal fluctuations are greatest in logging

The monthly employment in logging in Oregon, Washington, and California varied widely from winter to summer during the 1969-71 period, as would be expected for an activity dependent on good weather (fig. 27). The pattern of the variation for Washington and Oregon is very similar to that found by Smith and Gedney for the 1957-61 period. Communities which rely heavily on logging employment are faced with the effects of seasonal employment fluctuations.

During the 1969-71 period, average annual logging employment was lowest in January in western Washington (-28 percent) and in western Oregon (-20 percent). Employment rose to slightly above average in April in western Washington and in May in western Oregon and peaked in August in both areas (+11 percent in western Washington and +17 percent in western Oregon). Coastal California logging fluctuations are greater than those in western Washington and western Oregon. January and February logging employment was 47 percent below the annual average employment in coastal California; peak employment was recorded in August (+37 percent).

East of the Cascade Range and in interior California the logging employment fluctuations are more severe and the deviation pattern differs from the west side. In eastern Washington and in eastern Oregon, the monthly low employment was recorded in March (-43 percent and -50 percent, respectively). The low point in eastern Oregon was about the same as was recorded during

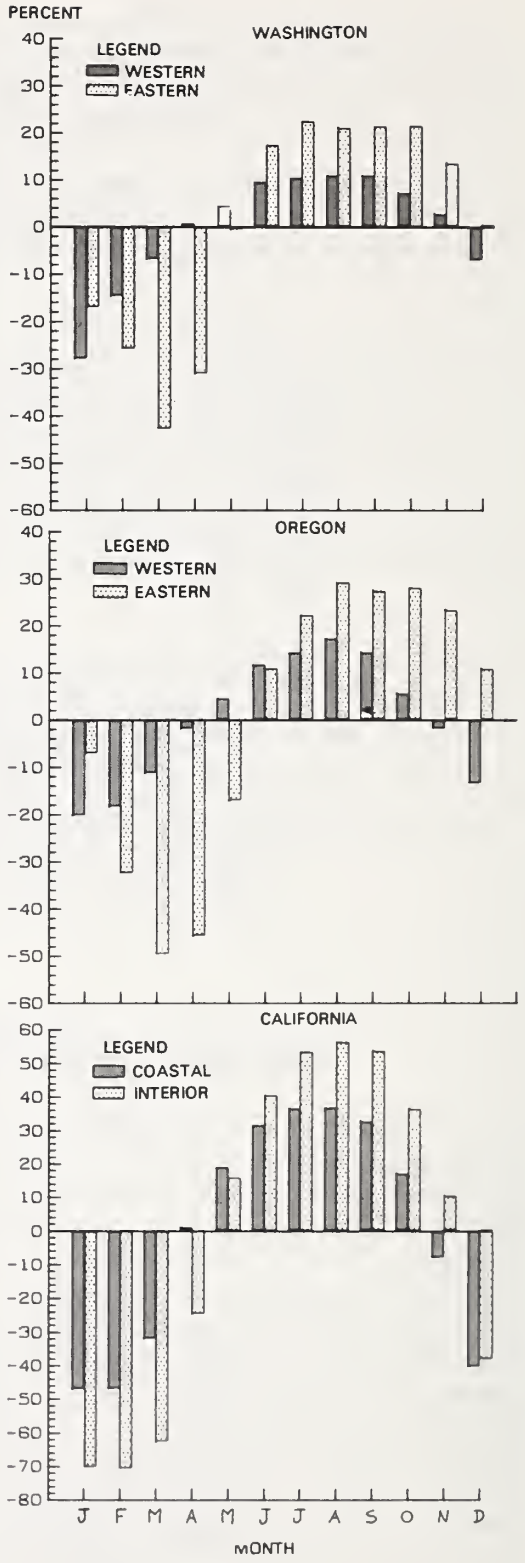



*Figure 27.--Monthly deviations from average employment in the logging industry in Washington, Oregon, and California, 1969-71.*

the 1957-61 period but in eastern Washington was less severe than the drop of 60 percent recorded a decade before (Smith and Gedney 1965). During the 1969-71 period, logging employment peaked in July at 22 percent above the average in eastern Washington and stayed around the 21-percent level through October. In eastern Oregon, logging employment peaked in August at 29 percent above the average and remained high in September and October. Interior California logging employment has the most severe fluctuations found in any segment of the forest products industry on the Pacific coast. January and February logging employment were below average annual employment by 70 and 71 percent, respectively. In May, interior California logging employment rose above average and peaked in August at +56 percent.

In Oregon there is evidence that the magnitude of the seasonal variation in logging (SIC 2411) steadily declined during the 1960's. This observation is based on monthly seasonal factor data supplied to us by the Oregon Employment Division of the Department of Human Resources. The data were for the whole State computed by the Seasonal Factor Method of the Bureau of Labor Statistics (BLS).

## Seasonal employment variation in sawmills and planing mills has diminished

Sawmills and planing mills have much less seasonal employment variation than do logging operations. For Washington and Oregon, the seasonal variation was smaller in the 1969-71 period than it was in the 1957-61 period. Smith and Gedney (1965) found that during the 1957-61 period "the range in Oregon was from 8 percent above average in August to 8 percent below in January and February. ... In Washington these same months marked a 6 percent high and a 7 percent low in monthly employment." They also found "no differences were apparent between mills in eastern and western Oregon, but in eastern Washington the range in monthly employment was much larger from summer to winter than in western Washington."

Figure 28 shows the sawmill and planing mill seasonal fluctuations by State area for Washington, Oregon, and California for the 1969-71 period. The fluctuations in each half-State area are smaller than those found in the earlier study, and the pattern is slightly different.

In western Washington, the sawmill and planing mill employment low was in January (-3 percent below the annual average); and in western Oregon, the low was in January and February (-4 percent). The high point in western Washington was in August (+2.5 percent above average); in western Oregon it was in June (+3 percent).

East of the Cascade Range, sawmill employment fluctuated more than west of the Cascades. The eastern Washington low point in employment was in February (-6 percent), and in eastern Oregon the low point was in March

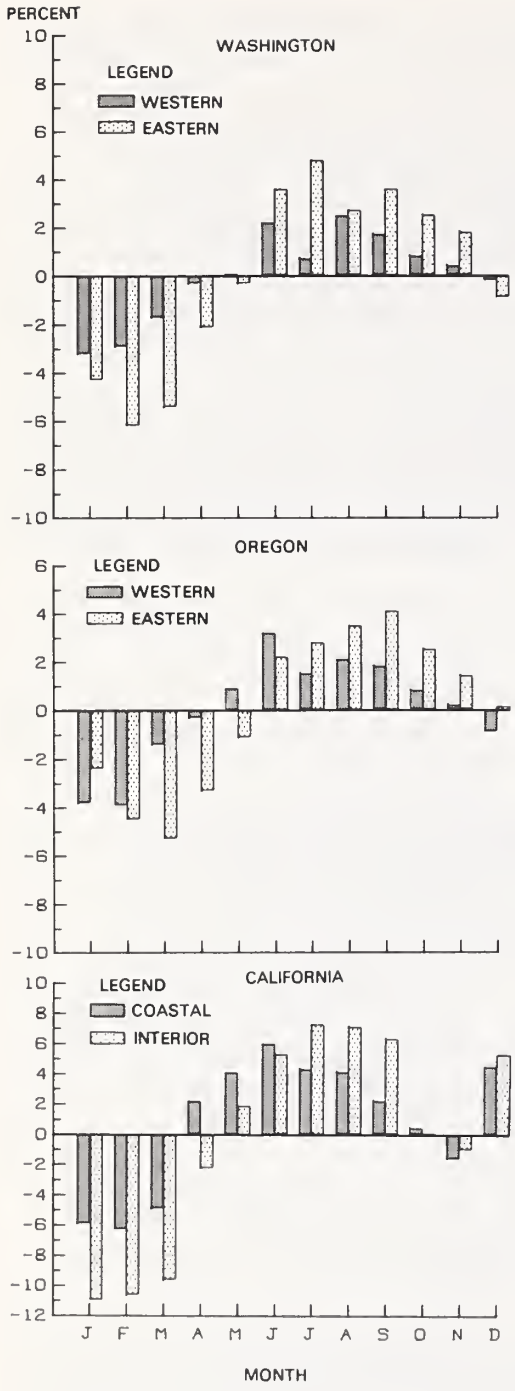



*Figure 28.--Monthly deviations from average employment in sawmills and planing mills in Washington, Oregon, and California, 1969-71.*

(-5 percent). The peak employment in eastern Washington was recorded in July (+5 percent); in eastern Oregon it was recorded in September (+4 percent).

California sawmills and planing mills had greater seasonal employment fluctuations in the 1969-71 period than did those in Washington and Oregon. Coastal California recorded a low in February (-6 percent) and a high in June (+6 percent). Interior California recorded a low in January (-11 percent below the annual average) and a peak in July (+7 percent).

For all of Oregon, the BLS Seasonal Factor Method data indicate that the seasonal variation for sawmills and planing mills (SIC 242) declined between 1961 and 1970. The seasonal labor force and unemployment records for Oregon seem to indicate that, even though seasonal employment and induced unemployment is declining in logging and sawmilling activities, the communities heavily dependent on them have unemployment problems which remain quite large. At present we do not know which factors account for the decline in seasonal variation, but further research in this area could lead to quicker solutions to the communities' seasonal unemployment problems.

## Fluctuations in veneer and plywood seasonal employment are small in Washington and Oregon, larger in California

During the 1969-71 period, the seasonal employment variation in Washington and Oregon veneer and plywood plants was small. Employment

in both States followed a seasonal pattern with a peak of about 2 percent above the annual average in June (fig. 29). Employment was lowest in December in Washington (-3 percent) and in February in Oregon (-2 percent). The fluctuations were slightly less than those found by Smith and Gedney for the 1957-61 period.

California veneer and plywood employment shows considerably more monthly variation than Oregon and Washington during the 1969-71 period. In January, employment was over 6 percent below the annual average. Employment peaked in April at nearly 6 percent above the annual average and remained high in May and June.

In Oregon, the amount of variation in veneer, plywood, and millwork was calculated by the BLS Seasonal Factor Method. Seasonal variation in this sector (SIC 243) has not changed to any major extent during the past decade. Because millwork was included in the factor method analysis, the results really cannot be directly compared with our measurements.

## Other segments of the lumber and wood products industry have seasonal patterns

Figure 30 shows the seasonal variation of the millwork industry for Washington, Oregon, and California during the 1969-71 period. The millwork plants in Washington State have relatively little fluctuation from month to month, whereas in Oregon and California the fluctuations are greater and the patterns differ. Both Oregon and California had low millwork employment levels in January (down over 5 percent), and both peaked in September (up over 5 percent in Oregon and 3 percent in California).

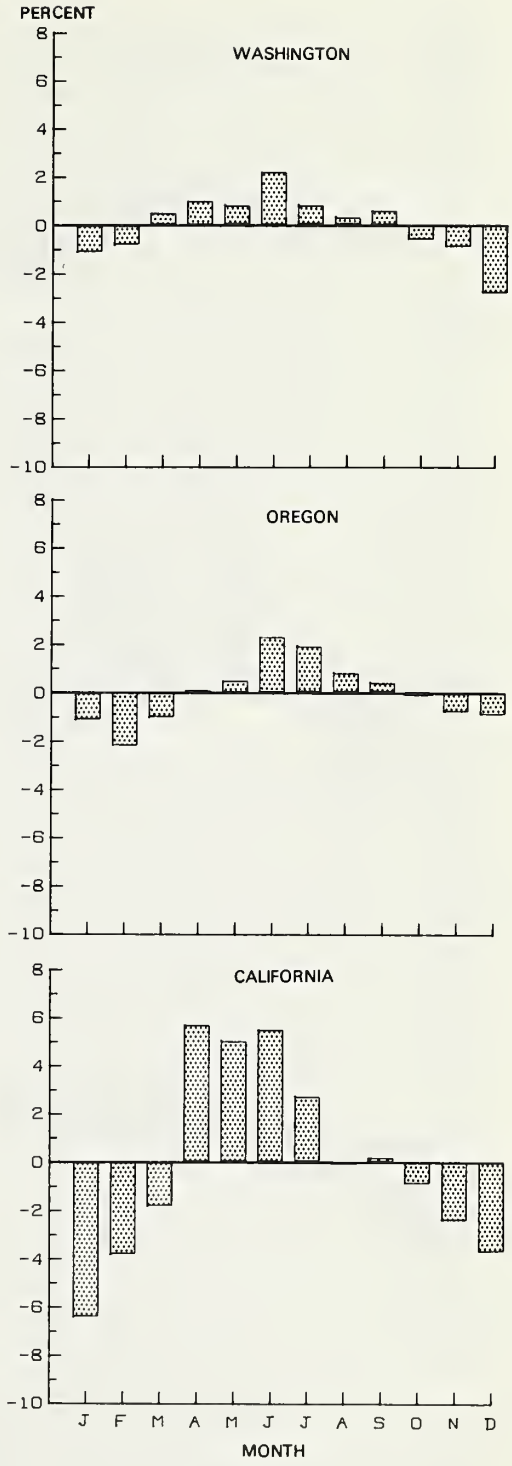



*Figure 29.--Monthly deviations from average employment in the veneer and plywood plants in Washington, Oregon, and California, 1969-71.*

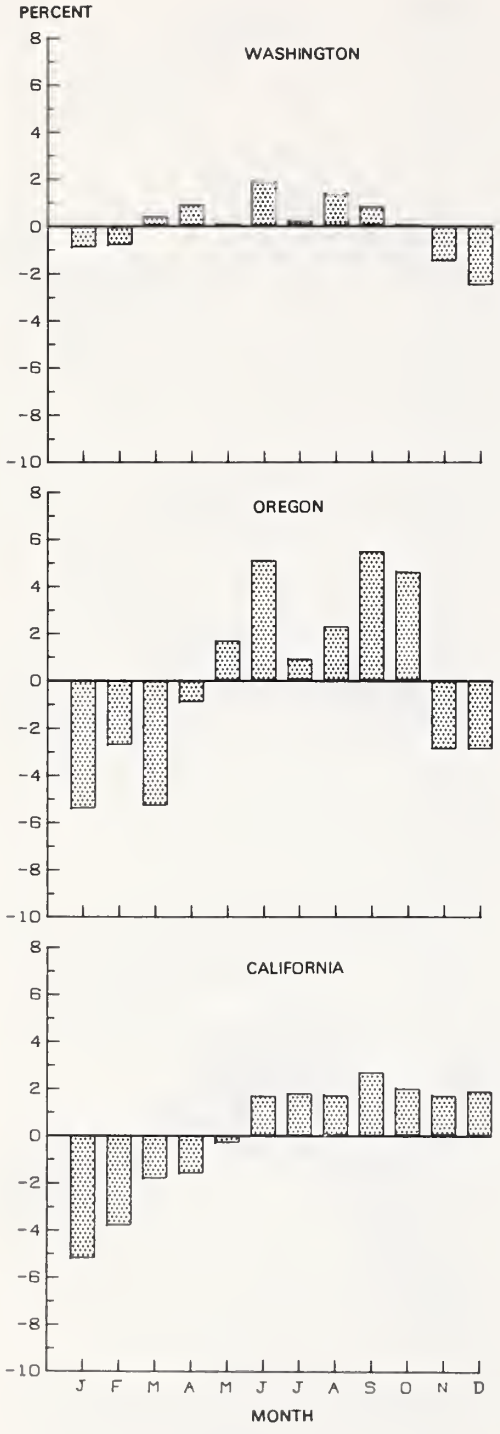



*Figure 30.--Monthly deviations from average employment in millwork plants in Washington, Oregon, and California, 1969-71.*

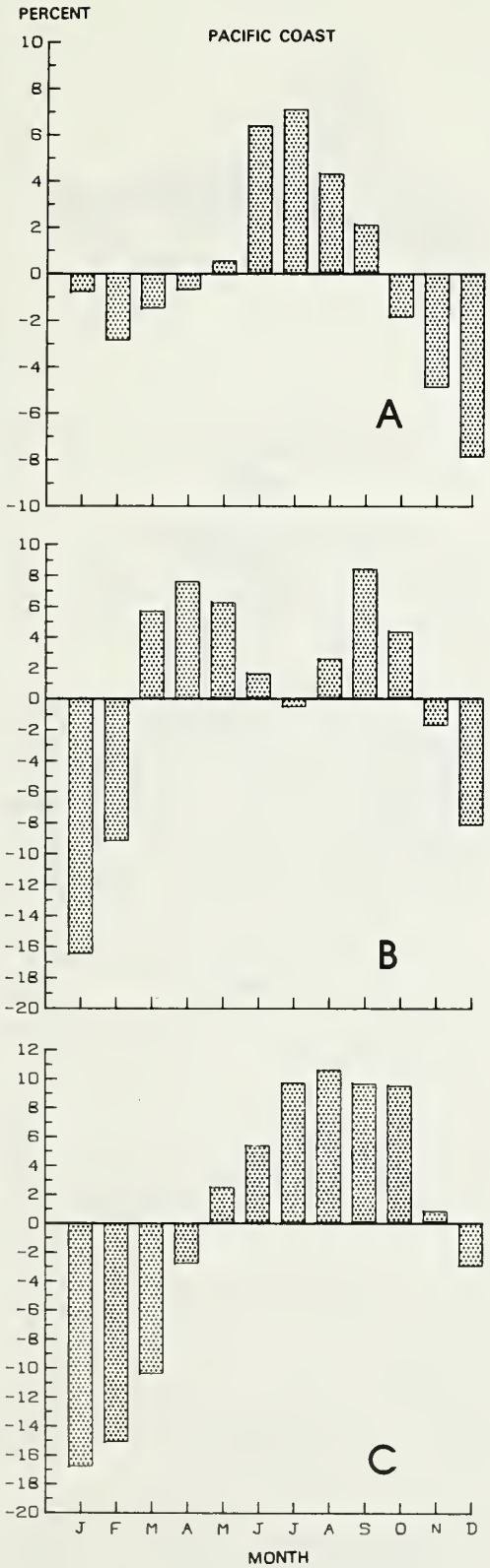
Seasonal employment fluctuations in other secondary manufacturing sectors of the lumber and wood products industry are shown in figure 31.

Special product sawmills which produce alder furniture stock and wood shingles and shakes have greater fluctuation than do the regular softwood lumber sawmills. On the Pacific coast, employment in this category was 16 percent below the average in January but peaked in April and in September at about 8 percent above the average.

## Labor strife distorts seasonal data for the pulp, paper, and paperboard industries

Usually the plants in the pulp, paper, and paperboard industries run at a rather steady pace throughout the year. Smith and Gedney (1965) found that during the 1957-61 period the Oregon pulp, paper, and paperboard firms experienced fairly stable employment conditions; employment varied from 4 percent above average in July to 2 or 3 percent below average from October through March. Peak summer months of employment were experienced each year.

During the 1969-71 period, California had the expected stability with employment fluctuating between plus and minus 2 percent (fig. 32). However, data for Washington and Oregon for the 1969-71 period are not typical of the usual pattern, for there were large drops in employment in April and May for the 3-year period. Closer examination of the data indicates that the April drop occurred in 1969 and the May employment drop occurred in 1971. These




unusual distortions in the monthly employment patterns are caused by labor strife at plants of several large corporations located in both Washington and Oregon. Figure 32 shows the unusual pattern for the period in Washington and Oregon as a result of these conditions.

The converted paper and paperboard products industry on the Pacific coast for the 1969-71 period shows a seasonal pattern (fig. 33). January and February are low months, somewhat less than 3 percent below the annual average employment. August and September are high months at slightly more than 2 percent above average. California, with most of the employment in this sector, had the smallest fluctuation.

The paperboard container and box industry on the Pacific coast has varying seasonal patterns by State. California has most of the employment in this sector, and its employment was more stable than either Washington's or Oregon's during the 1969-71 period, likely due to the fact that less of the total container output in California goes to the highly seasonal agricultural sector (fig. 34).

Figure 35 shows the seasonal employment variation for the building paper and building board industry on the Pacific coast. Employment in this industry is below average from October through February during the

*Figure 31.--Monthly deviations from average employment on the Pacific coast, 1969-71, in the: A, wood preservation industry; B, special product sawmills industry; and C, prefabricated wooden building and structural member industry.*

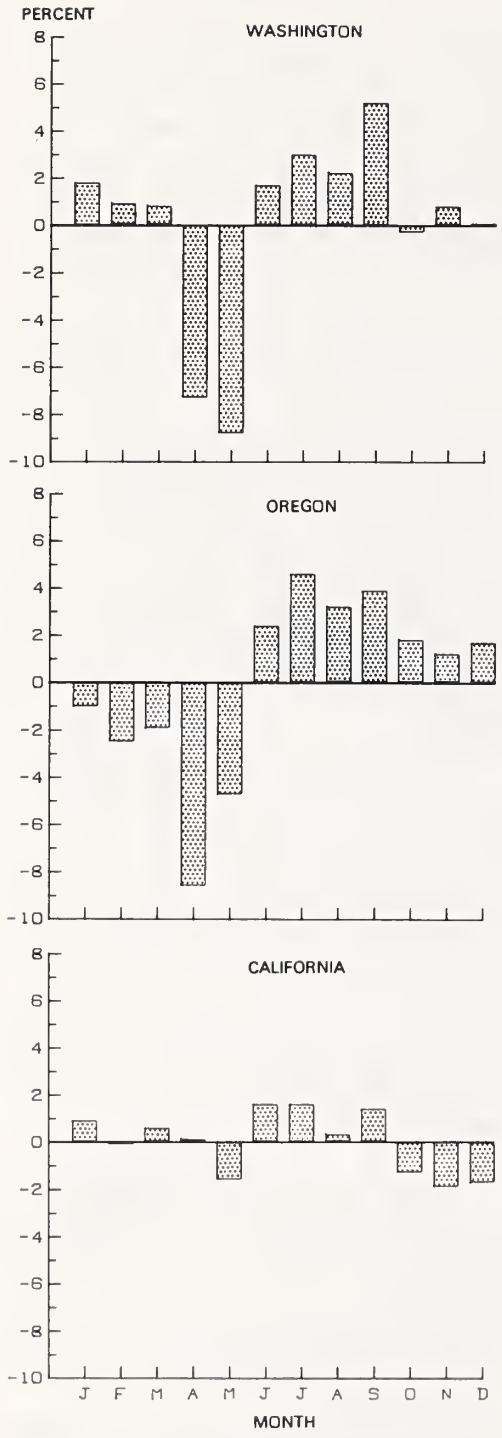



*Figure 32.--Monthly deviations from average employment in the pulp, paper, and paperboard industry in Washington, Oregon, and California, 1969-71.*

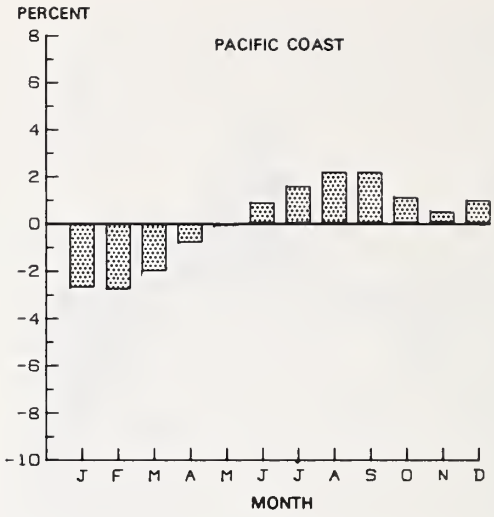



*Figure 33.--Monthly deviations from average employment in the converted paper and paperboard product industry on the Pacific coast, 1969-71.*

1969-71 period with a low recorded in December at over 5 percent below average. June and July were peak months at 4 percent above the annual average level of employment. The fluctuations are likely due to the seasonal pattern in construction.

Although employment in some sectors of the forest products industries displays only nominal seasonal fluctuations, it is evident that this pattern is similar for most of the sectors. The summer and early fall are periods of high production, and high employment; the early and late months of the year are characterized by lower production and employment levels. Consequently, areas with a diversity of forest products exhibit the same general seasonal employment patterns as areas with little diversity in forest products industries. The magnitude of fluctuations could of course be quite different from area to area depending on the mix of industries. There is indication that the fluctuations are lessening with the passage of time.

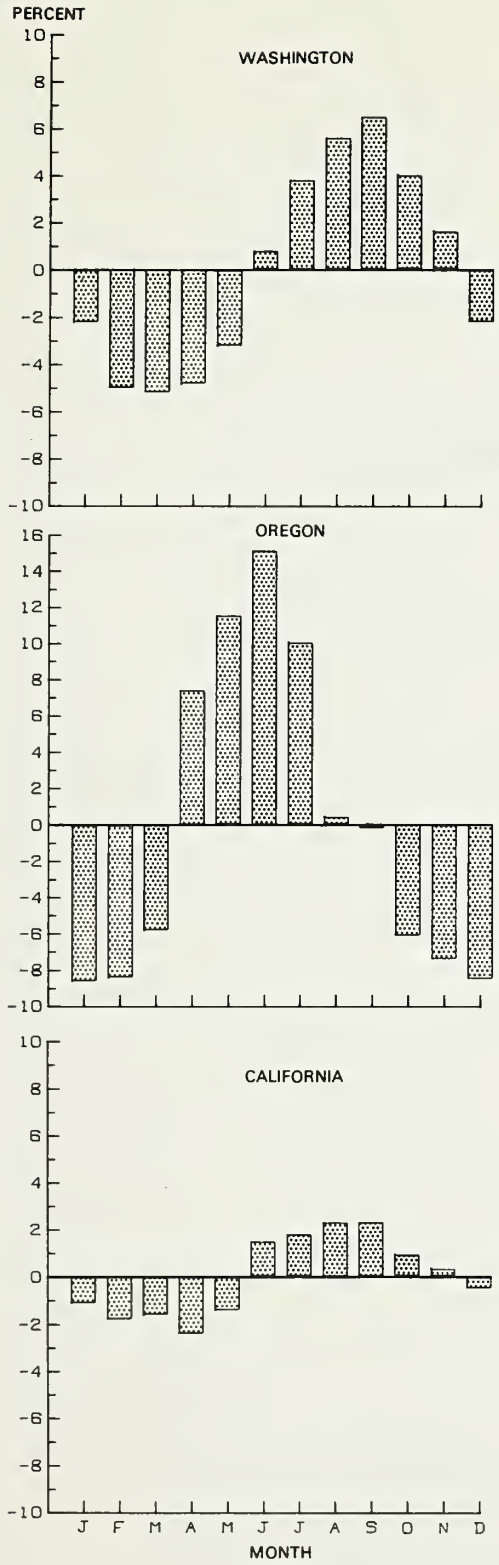



*Figure 34.--Monthly deviations from average employment in the paperboard container and box industry in Washington, Oregon, and California, 1969-71.*

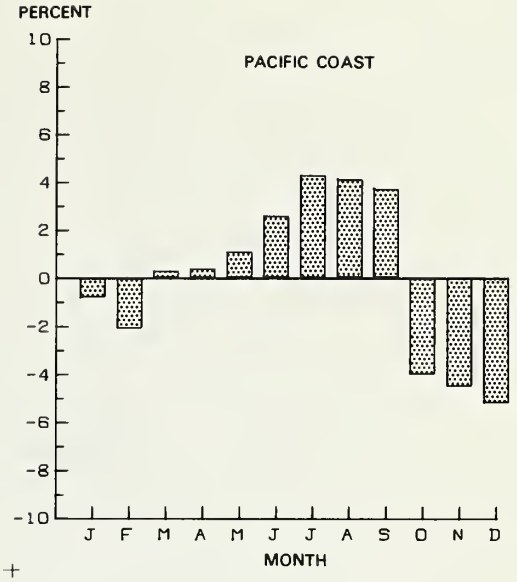



*Figure 35.--Monthly deviations from average employment in the building paper and building board industry on the Pacific coast, 1969-71.*

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# APPENDIX OF TABLES

*Table 1.--Average annual employment in the lumber and wood products and paper and allied products industries of Washington, Oregon, and California by State area, 1971*

| Industry | Standard Industrial Classification[1/] | Washington | | | Oregon | | | California | | | Total Pacific coast |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Western | Eastern | Total | Western | Eastern | Total | Coastal | Interior | Total | |
| | | *Number of employees* | | | | | | | | | |
| Lumber and wood products: | | | | | | | | | | | |
| Logging | 2411 | 10,359 | 1,342 | 11,701 | 9,881 | 1,607 | 11,488 | 1,613 | 2,525 | 4,138 | 27,327 |
| Sawmills and planing mills | 2421 | 11,573 | 3,605 | 15,178 | 16,083 | 7,349 | 23,432 | 9,818 | 11,009 | 20,827 | 59,437 |
| Special product sawmills and hardwood mills | 2426, 2429 | (2/) | (2/) | 2,560 | (2/) | (2/) | 728 | (2/) | (2/) | 269 | 3,557 |
| Millwork | 2431 | 2,590 | 577 | 3,167 | 2,258 | 1,848 | 4,106 | 1,022 | 6,746 | 7,768 | 15,041 |
| Veneer and plywood | 2432 | 7,469 | 851 | 8,320 | 24,587 | 960 | 25,547 | 2,093 | 2,073 | 4,166 | 38,033 |
| Prefabricated wooden buildings and structural members | 2433 | 1,006 | 190 | 1,196 | (2/) | (2/) | 995 | 1,068 | 1,131 | 2,199 | 4,390 |
| Wooden containers | 2441, 2442, 2443, 2445 | 95 | 29 | 124 | 586 | 48 | 634 | 437 | 3,772 | 4,209 | 4,967 |
| Wood preserving | 2491 | (2/) | (2/) | 539 | (2/) | (2/) | 380 | (2/) | (2/) | 315 | 1,234 |
| Miscellaneous wood products | 2499 | 554 | 45 | 599 | 2,650 | 339 | 2,989 | 1,977 | 4,501 | 6,478 | 10,066 |
| Total lumber and wood products | | 36,658 | 6,726 | 43,384 | 58,011 | 12,288 | 70,299 | 18,119 | 32,250 | 50,369 | 164,052 |
| Paper and allied products: | | | | | | | | | | | |
| Pulpmills | 2611 | 2,424 | -- | 2,424 | 301 | -- | 301 | (2/) | (2/) | 419 | 3,144 |
| Paper, paperboard, building paper, and building board | 2621, 2631, 2661 | (2/) | (2/) | 11,599 | (2/) | (2/) | 6,608 | 3,252 | 4,512 | 7,764 | 25,971 |
| Converted paper and paperboard products | 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2649 | 1,803 | 139 | 1,942 | 1,754 | -- | 1,754 | 3,171 | 9,493 | 12,664 | 16,360 |
| Paperboard containers and boxes | 2651, 2652, 2653, 2654, 2655 | 1,769 | 337 | 2,106 | 761 | -- | 761 | 4,055 | 10,569 | 14,624 | 17,491 |
| Total paper and allied products | | (2/) | (2/) | 18,071 | (2/) | (2/) | 9,424 | (2/) | (2/) | 35,471 | 62,966 |
| Total, all industries | | (2/) | (2/) | 61,455 | (2/) | (2/) | 79,723 | (2/) | (2/) | 85,840 | 227,018 |

1/ Standard Industrial Classification (SIC) for 1967.

2/ State areas have been combined to avoid disclosure of individual mill statistics.

Table 2.--*Average annual employment in the lumber and wood products industry in Washington, Oregon, and California, by State area, 1950-71*

(Number of employees)

| Year | Pacific coast total[1/] | Washington | | | Oregon | | | California | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Western | Eastern | Total | Western | Eastern | Total[1/] | Coastal | Interior |
| 1950 | 188,182 | 57,975 | 50,166 | 7,809 | 77,507 | 64,133 | 13,374 | 52,700 | (2/) | (2/) |
| 1951 | 202,812 | 60,754 | 52,551 | 8,203 | 84,058 | 70,873 | 13,185 | 58,000 | (2/) | (2/) |
| 1952 | 196,292 | 54,957 | 47,040 | 7,917 | 82,835 | 70,651 | 12,184 | 58,500 | (2/) | (2/) |
| 1953 | 190,243 | 52,907 | 44,861 | 8,046 | 78,936 | 66,292 | 12,644 | 58,400 | (2/) | (2/) |
| 1954 | 176,868 | 46,497 | 38,784 | 7,713 | 73,771 | 61,344 | 12,427 | 56,600 | (2/) | (2/) |
| 1955 | 194,491 | 52,312 | 44,196 | 8,116 | 79,779 | 66,592 | 13,187 | 62,400 | (2/) | (2/) |
| 1956 | 189,547 | 50,644 | 42,533 | 8,111 | 77,903 | 64,594 | 13,309 | 61,000 | (2/) | (2/) |
| 1957 | 170,363 | 44,891 | 37,269 | 7,622 | 70,172 | 58,092 | 12,080 | 55,300 | (2/) | (2/) |
| 1958 | 164,718 | 42,276 | 34,951 | 7,325 | 68,842 | 56,692 | 12,150 | 53,600 | (2/) | (2/) |
| 1959 | 179,949 | 46,919 | 38,392 | 8,527 | 74,230 | 61,739 | 12,491 | 58,800 | (2/) | (2/) |
| 1960 | 171,089 | 44,411 | 36,438 | 7,973 | 71,751 | 60,309 | 11,442 | 54,927 | 23,196 | 31,731 |
| 1961 | 159,814 | 41,710 | 34,704 | 7,006 | 66,980 | 56,620 | 10,360 | 51,124 | 20,994 | 30,130 |
| 1962 | 163,167 | 42,963 | 35,817 | 7,146 | 68,786 | 58,451 | 10,335 | 51,418 | 21,574 | 29,844 |
| 1963 | 164,058 | 43,661 | 36,083 | 7,578 | 69,090 | 58,551 | 10,539 | 51,307 | 21,105 | 30,202 |
| 1964 | 172,881 | 46,671 | 38,972 | 7,699 | 73,178 | 62,409 | 10,769 | 53,032 | 21,644 | 31,388 |
| 1965 | 172,372 | 46,935 | 39,275 | 7,660 | 74,323 | 62,960 | 11,363 | 51,114 | 20,835 | 30,279 |
| 1966 | 169,924 | 46,571 | 39,433 | 7,138 | 73,068 | 61,851 | 11,217 | 50,285 | 20,223 | 30,062 |
| 1967 | 160,545 | 44,023 | 37,161 | 6,862 | 69,457 | 58,026 | 11,431 | 47,065 | 17,998 | 29,067 |
| 1968 | 168,033 | 45,962 | 38,690 | 7,272 | 72,342 | 60,511 | 11,831 | 49,729 | 18,912 | 30,817 |
| 1969 | 166,924 | 45,188 | 38,163 | 7,025 | 70,959 | 59,390 | 11,569 | 50,777 | 19,327 | 31,450 |
| 1970 | 157,074 | 42,223 | 36,062 | 6,161 | 66,768 | 55,360 | 11,408 | 48,083 | 17,382 | 30,701 |
| 1971 | 164,052 | 43,384 | 36,658 | 6,726 | 70,299 | 58,011 | 12,288 | 50,369 | 18,119 | 32,250 |

[1/] Source of California data for 1950-59: Bureau of Labor Statistics, U.S. Department of Labor

[2/] No breakdown available, 1950-59.

Table 3.--*Average annual employment in logging (SIC 2411) in Washington Oregon, and California by State area, 1950-71*

(Number of employees)

| Year | Pacific coast total | Washington | | | Oregon | | | California | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Western | Eastern | Total | Western | Eastern | Total | Coastal | Interior |
| 1950 | (1/) | 13,899 | 12,583 | 1,316 | 14,765 | 12,774 | 1,991 | (1/) | (1/) | (1/) |
| 1951 | (1/) | 15,119 | 13,622 | 1,497 | 16,290 | 14,409 | 1,881 | (1/) | (1/) | (1/) |
| 1952 | (1/) | 12,645 | 11,203 | 1,442 | 15,461 | 13,835 | 1,626 | (1/) | (1/) | (1/) |
| 1953 | (1/) | 11,134 | 9,691 | 1,443 | 13,685 | 12,005 | 1,680 | (1/) | (1/) | (1/) |
| 1954 | (1/) | 9,759 | 8,398 | 1,361 | 12,927 | 11,329 | 1,598 | (1/) | (1/) | (1/) |
| 1955 | (1/) | 11,145 | 9,537 | 1,608 | 13,678 | 12,109 | 1,569 | (1/) | (1/) | (1/) |
| 1956 | (1/) | 13,040 | 11,261 | 1,779 | 14,446 | 12,580 | 1,866 | (1/) | (1/) | (1/) |
| 1957 | (1/) | 10,444 | 8,855 | 1,589 | 12,064 | 10,564 | 1,500 | (1/) | (1/) | (1/) |
| 1958 | (1/) | 9,955 | 8,359 | 1,596 | 11,992 | 10,323 | 1,669 | (1/) | (1/) | (1/) |
| 1959 | (1/) | 11,379 | 9,579 | 1,800 | 13,291 | 11,429 | 1,862 | (1/) | (1/) | (1/) |
| 1960 | 29,080 | 10,996 | 9,302 | 1,694 | 12,751 | 11,159 | 1,592 | 5,333 | 2,684 | 2,649 |
| 1961 | 26,676 | 10,305 | 8,877 | 1,428 | 11,794 | 10,369 | 1,425 | 4,577 | 2,300 | 2,277 |
| 1962 | 27,605 | 10,595 | 9,209 | 1,386 | 12,380 | 11,047 | 1,333 | 4,630 | 2,288 | 2,342 |
| 1963 | 28,253 | 11,112 | 9,514 | 1,598 | 12,557 | 11,054 | 1,503 | 4,584 | 2,192 | 2,392 |
| 1964 | 30,428 | 12,338 | 10,676 | 1,662 | 13,309 | 11,658 | 1,651 | 4,781 | 2,328 | 2,453 |
| 1965 | 30,719 | 12,608 | 10,970 | 1,638 | 13,453 | 11,749 | 1,704 | 4,658 | 2,216 | 2,442 |
| 1966 | 28,479 | 11,978 | 10,419 | 1,559 | 12,344 | 10,848 | 1,496 | 4,157 | 1,828 | 2,329 |
| 1967 | 27,761 | 11,775 | 10,177 | 1,598 | 12,013 | 10,336 | 1,677 | 3,973 | 1,717 | 2,256 |
| 1968 | 30,089 | 12,846 | 11,209 | 1,637 | 12,736 | 10,909 | 1,827 | 4,507 | 1,953 | 2,554 |
| 1969 | 29,941 | 12,940 | 11,395 | 1,545 | 12,424 | 10,686 | 1,738 | 4,577 | 1,889 | 2,688 |
| 1970 | 27,081 | 12,247 | 10,968 | 1,279 | 11,102 | 9,586 | 1,516 | 3,732 | 1,481 | 2,251 |
| 1971 | 27,327 | 11,701 | 10,359 | 1,342 | 11,488 | 9,881 | 1,607 | 4,138 | 1,613 | 2,525 |

1/ California data for 1950-59 not available.

Table 4.--*Average annual employment in sawmills and planing mills (SIC 2421) in Washington, Oregon, and California by State area, 1950-71*

(Number of employees)

| Year | Pacific coast total | Washington | | | Oregon | | | California | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Western | Eastern | Total | Western | Eastern | Total | Coastal | Interior |
| 1950 | (1/) | 24,775 | 19,999 | 4,776 | 49,281 | 38,790 | 10,491 | (1/) | (1/) | (1/) |
| 1951 | (1/) | 26,019 | 21,491 | 4,528 | 51,933 | 41,633 | 10,300 | (1/) | (1/) | (1/) |
| 1952 | (1/) | 24,560 | 19,578 | 4,982 | 50,345 | 41,028 | 9,317 | (1/) | (1/) | (1/) |
| 1953 | (1/) | 24,117 | 18,939 | 5,178 | 47,617 | 37,850 | 9,767 | (1/) | (1/) | (1/) |
| 1954 | (1/) | 20,920 | 15,891 | 5,029 | 43,870 | 34,012 | 9,858 | (1/) | (1/) | (1/) |
| 1955 | (1/) | 23,141 | 17,911 | 5,230 | 46,754 | 36,007 | 10,747 | (1/) | (1/) | (1/) |
| 1956 | (1/) | 20,266 | 15,125 | 5,141 | 42,332 | 31,742 | 10,590 | (1/) | (1/) | (1/) |
| 1957 | (1/) | 18,302 | 13,437 | 4,865 | 36,164 | 26,375 | 9,789 | (1/) | (1/) | (1/) |
| 1958 | (1/) | 16,604 | 11,998 | 4,606 | 32,162 | 23,468 | 8,694 | (1/) | (1/) | (1/) |
| 1959 | (1/) | 18,355 | 12,790 | 5,565 | 33,620 | 24,720 | 8,900 | (1/) | (1/) | (1/) |
| 1960 | 75,855 | 17,631 | 12,280 | 5,351 | 30,719 | 22,479 | 8,240 | 27,505 | 12,742 | 14,763 |
| 1961 | 68,011 | 16,078 | 11,416 | 4,662 | 26,495 | 19,006 | 7,489 | 25,438 | 11,368 | 14,070 |
| 1962 | 67,660 | 16,253 | 11,539 | 4,714 | 26,600 | 19,097 | 7,503 | 24,807 | 11,552 | 13,255 |
| 1963 | 66,376 | 15,811 | 11,048 | 4,763 | 25,961 | 18,554 | 7,407 | 24,604 | 11,332 | 13,272 |
| 1964 | 67,139 | 16,574 | 11,808 | 4,766 | 26,023 | 18,814 | 7,209 | 24,542 | 11,316 | 13,226 |
| 1965 | 65,286 | 16,471 | 11,682 | 4,789 | 25,507 | 18,230 | 7,277 | 23,308 | 10,469 | 12,839 |
| 1966 | 63,962 | 16,537 | 12,048 | 4,489 | 25,022 | 17,705 | 7,317 | 22,403 | 10,031 | 12,372 |
| 1967 | 59,867 | 15,394 | 11,314 | 4,080 | 23,465 | 16,320 | 7,145 | 21,008 | 9,233 | 11,775 |
| 1968 | 61,309 | 15,799 | 11,506 | 4,293 | 23,715 | 16,667 | 7,048 | 21,795 | 9,916 | 11,879 |
| 1969 | 60,794 | 15,363 | 11,503 | 3,860 | 23,492 | 16,474 | 7,018 | 21,939 | 10,334 | 11,605 |
| 1970 | 57,676 | 14,760 | 11,342 | 3,418 | 22,372 | 15,532 | 6,840 | 20,544 | 9,751 | 10,793 |
| 1971 | 59,437 | 15,178 | 11,573 | 3,605 | 23,432 | 16,083 | 7,349 | 20,827 | 9,818 | 11,009 |

1/ California data for 1950-59 not available.

Table 5.--*Average annual employment in veneer and plywood plants (SIC 2432), Washington, Oregon, and California, 1950-71*

(Number of employees)

| Year | Pacific coast total | Washington | Oregon | California |
|---|---|---|---|---|
| 1950 | (1/) | 11,280 | 6,290 | (1/) |
| 1951 | (1/) | 11,395 | 7,989 | (1/) |
| 1952 | (1/) | 10,100 | 10,369 | (1/) |
| 1953 | (1/) | 10,086 | 10,837 | (1/) |
| 1954 | (1/) | 8,977 | 10,956 | (1/) |
| 1955 | (1/) | 10,344 | 12,625 | (1/) |
| 1956 | (1/) | 9,789 | 14,149 | (1/) |
| 1957 | (1/) | 9,243 | 14,968 | (1/) |
| 1958 | (1/) | 8,701 | 18,428 | (1/) |
| 1959 | (1/) | 9,548 | 20,729 | (1/) |
| 1960 | 36,292 | 9,005 | 21,849 | 5,438 |
| 1961 | 36,238 | 8,696 | 22,600 | 4,942 |
| 1962 | 38,136 | 9,146 | 23,693 | 5,297 |
| 1963 | 37,958 | 9,033 | 24,007 | 4,918 |
| 1964 | 42,312 | 10,271 | 26,504 | 5,537 |
| 1965 | 43,439 | 10,480 | 27,629 | 5,330 |
| 1966 | 43,463 | 10,612 | 27,435 | 5,416 |
| 1967 | 39,462 | 9,623 | 25,363 | 4,476 |
| 1968 | 39,754 | 9,216 | 26,196 | 4,342 |
| 1969 | 38,470 | 8,703 | 25,342 | 4,425 |
| 1970 | 36,277 | 7,856 | 24,470 | 3,951 |
| 1971 | 38,033 | 8,320 | 25,547 | 4,166 |

1/ California data for 1950-59 not available.

Table 6.--*Average annual employment in the paper and allied products industry (SIC 26) in Washington, Oregon, and California, 1950-71*[1/]

(Number of employees)

| Year | Pacific coast total[2/] | Washington | Oregon | California[2/] |
|---|---|---|---|---|
| 1950 | 33,100 | 14,067 | 5,538 | 13,500 |
| 1951 | 36,900 | 15,100 | 5,917 | 15,800 |
| 1952 | 38,000 | 15,440 | 6,129 | 16,500 |
| 1953 | 40,400 | 15,703 | 6,363 | 18,300 |
| 1954 | 42,200 | 16,039 | 6,412 | 19,700 |
| 1955 | 44,900 | 16,881 | 6,584 | 21,400 |
| 1956 | 47,600 | 17,311 | 7,059 | 23,200 |
| 1957 | 49,000 | 17,202 | 7,091 | 24,700 |
| 1958 | 48,700 | 16,803 | 7,072 | 24,900 |
| 1959 | 51,900 | 17,387 | 7,558 | 26,900 |
| 1960 | 52,471 | 17,967 | 7,310 | 27,194 |
| 1961 | 52,902 | 17,844 | 7,261 | 27,797 |
| 1962 | 54,948 | 18,302 | 7,278 | 29,368 |
| 1963 | 56,318 | 18,804 | 7,366 | 30,148 |
| 1964 | 56,476 | 19,249 | 7,229 | 29,998 |
| 1965 | 57,961 | 19,776 | 7,520 | 30,665 |
| 1966 | 60,952 | 20,266 | 8,046 | 32,640 |
| 1967 | 61,956 | 19,879 | 8,464 | 33,613 |
| 1968 | 63,687 | 19,940 | 8,774 | 34,973 |
| 1969 | 65,533 | 19,979 | 9,103 | 36,451 |
| 1970 | 65,274 | 19,146 | 9,361 | 36,767 |
| 1971 | 62,966 | 18,071 | 9,424 | 35,471 |

[1/] Includes hardboard manufacturing employment through 1963.

[2/] Source of California data for 1950-59: Bureau of Labor Statistics, U.S. Department of Labor.

Table 7.--*Average annual employment in pulp, paper, paperboard, and building paper establishments*[1/] *in Washington, Oregon, and California, 1960-71*

| Year | Pacific coast total | Washington | Oregon | California[2/] |
|---|---|---|---|---|
| 1960 | 27,359 | 15,638 | 5,705 | 6,016 |
| 1961 | 27,124 | 15,313 | 5,679 | 6,132 |
| 1962 | 27,480 | 15,553 | 5,674 | 6,253 |
| 1963 | 27,912 | 15,823 | 5,641 | 6,448 |
| 1964 | 28,216 | 16,103 | 5,440 | 6,673 |
| 1965 | 29,564 | 15,914 | 5,849 | 7,801 |
| 1966 | 30,608 | 16,063 | 5,659 | 8,886 |
| 1967 | 30,862 | 15,661 | 6,176 | 9,025 |
| 1968 | 31,004 | 15,668 | 6,384 | 8,952 |
| 1969 | 30,944 | 15,468 | 6,635 | 8,841 |
| 1970 | 30,665 | 15,576 | 6,908 | 8,181 |
| 1971 | 29,115 | 14,023 | 6,909 | 8,183 |

[1/] SIC codes 2611, 2621, 2631, 2661.

[2/] Excludes hardboard manufacturing employment.

*Table 8.--Equations showing the relationship of employment per unit of wood consumption with respect to time by industry category and State area*

| State area and industry | SIC code | Equation | $F$ value | Period | $R^2$ | Degrees of freedom |
|---|---|---|---|---|---|---|
| Western Washington logging[1/] | 2411 | $Y = 3.105 - 0.0622X$ | 114.1 | 1950-70 | 0.86 | 19 |
| Eastern Washington logging[1/] | 2411 | $Y = 2.460 - 0.0536X$ | 107.3 | 1950-70 | .85 | 19 |
| Washington veneer and plywood[1/] | 2432 | $Y = 20.019 - 0.4376X$ | 160.9 | 1950-70 | .89 | 19 |
| | | $Y = 22.380 - 3.3201 \log X$ | 159.8 | 1950-70 | .89 | 19 |
| | | $\text{Log } Y = 3.159 - 0.2101 \log X$ | 108.1 | 1950-70 | .85 | 19 |
| | | $\text{Log } Y = 3.020 - 0.0286X$ | 193.6 | 1950-70 | .91 | 19 |
| Western Washington sawmills and planing mills[1/] | 2421 | $Y = 8.051 - 0.1482X$ | 43.0 | 1950-70 | .69 | 19 |
| | | $Y = 8.876 - 1.1363 \log X$ | 46.1 | 1950-70 | .71 | 19 |
| | | $\text{Log } Y = 2.211 - 0.1689 \log X$ | 44.9 | 1950-70 | .70 | 19 |
| | | $\text{Log } Y = 2.089 - 0.0220X$ | 42.9 | 1950-70 | .69 | 19 |
| Eastern Washington sawmills and planing mills[1/] | 2421 | $Y = 7.519 - 0.1689X$ | 306.8 | 1950-70 | .94 | 19 |
| | | $Y = 8.375 - 1.2562 \log X$ | 179.3 | 1950-70 | .90 | 19 |
| | | $\text{Log } Y = 2.180 - 0.2146 \log X$ | 126.8 | 1950-70 | .87 | 19 |
| | | $\text{Log } Y = 2.043 - 0.0297X$ | 458.7 | 1950-70 | .96 | 19 |
| Washington paper and allied products[2/] | 26 | $Y = 4.095 - 0.1321X$ | 361.1 | 1958-70 | .97 | 11 |
| | | $Y = 4.291 - 0.6459 \log X$ | 95.5 | 1958-70 | .90 | 11 |
| | | $\text{Log } Y = 1.490 - 0.2009 \log X$ | 65.2 | 1958-70 | .86 | 11 |
| | | $\text{Log } Y = 1.435 - 0.0420X$ | 338.6 | 1958-70 | .97 | 11 |
| Washington pulp, paper, paperboard, and building paper[2/] | 2611 | $Y = 3.606 - 0.1378X$ | 336.4 | 1958-70 | .97 | 11 |
| | 2621 | $Y = 3.819 - 0.6783 \log X$ | 106.8 | 1958-70 | .91 | 11 |
| | 2631 | $\text{Log } Y = 1.389 - 0.2521 \log X$ | 70.9 | 1958-70 | .87 | 11 |
| | 2661 | $\text{Log } Y = 1.3193 - 0.05251X$ | 386.7 | 1958-70 | .97 | 11 |
| Western Oregon logging[1/] | 2411 | $Y = 1.746 - 0.0128X$ | 12.5 | 1950-70 | .40 | 19 |
| Eastern Oregon logging[1/] | 2411 | $Y = 1.466 - 0.0338X$ | 51.1 | 1950-70 | .73 | 19 |
| | | $Y = 1.718 - 0.2887 \log X$ | 232.3 | 1950-70 | .92 | 19 |
| | | $\text{Log } Y = 0.581 - 0.2370 \log X$ | 230.2 | 1950-70 | .92 | 19 |
| | | $\text{Log } Y = 0.388 - 0.0290X$ | 75.4 | 1950-70 | .80 | 19 |
| Oregon veneer and plywood[1/] | 2432 | $Y = 14.6011 - 0.4969X$ | 64.3 | 1950-70 | .77 | 19 |
| | | $Y = 16.9486 - 3.1578 \log X$ | 79.5 | 1950-70 | .81 | 19 |
| | | $\text{Log } Y = 2.904 - 0.2879 \log X$ | 103.3 | 1950-70 | .85 | 19 |
| | | $\text{Log } Y = 2.700 - 0.03807X$ | 108.2 | 1950-70 | .85 | 19 |
| Western Oregon sawmills and planing mills[1/] | 2421 | $Y = 7.832 - 0.2135X$ | 194.2 | 1950-70 | .91 | 19 |
| | | $Y = 8.886 - 1.5746 \log X$ | 117.0 | 1950-70 | .86 | 19 |
| | | $\text{Log } Y = 2.270 - 0.2768 \log X$ | 99.0 | 1950-70 | .84 | 19 |
| | | $\text{Log } Y = 2.095 - 0.0384X$ | 258.0 | 1950-70 | .93 | 19 |

*Table 8.--Equations showing the relationship of employment per unit of wood consumption with respect to time by industry category and State area--Continued*

| State area and industry | SIC code | Equation | $F$ value | Period | $R^2$ | Degrees of freedom |
|---|---|---|---|---|---|---|
| Eastern Oregon sawmills and planing mills[1] | 2421 | $Y = 7.172 - 0.1521X$ | 91.9 | 1950-70 | 0.83 | 19 |
| | | $Y = 7.999 - 1.1567 \log X$ | 94.4 | 1950-70 | .83 | 19 |
| | | $\text{Log } Y = 2.125 - 0.2023 \log X$ | 79.4 | 1950-70 | .81 | 19 |
| | | $\text{Log } Y = 1.985 - 0.0270X$ | 92.1 | 1950-70 | .83 | 19 |
| Oregon paper and allied products[2] | 26 | $Y = 5.297 - 0.2619X$ | 237.5 | 1958-70 | .96 | 11 |
| | | $Y = 5.697 - 1.2876 \log X$ | 91.0 | 1958-70 | .89 | 11 |
| | | $\text{Log } Y = 1.835 - 0.3665 \log X$ | 59.5 | 1958-70 | .84 | 11 |
| | | $\text{Log } Y = 1.738 - 0.07699X$ | 293.5 | 1958-70 | .96 | 11 |
| Oregon pulp, paper, paperboard, and building paper[2] | 2611 | $Y = 4.0275 - 0.2042X$ | 236.2 | 1958-70 | .96 | 11 |
| | 2621 | $Y = 4.313 - 0.9887 \log X$ | 70.5 | 1958-70 | .87 | 11 |
| | 2631 | $\text{Log } Y = 1.566 - 0.3798 \log X$ | 48.2 | 1958-70 | .81 | 11 |
| | 2661 | $\text{Log } Y = 1.473 - 0.0808X$ | 230.4 | 1958-70 | .95 | 11 |
| Interior California logging[1] | 2411 | $Y = 0.813 + 0.00147X$ | .085 | 1960-71 | .01 | 10 |
| Coastal California logging[1] | 2411 | $Y = 1.030 - 0.0173X$ | 9.5 | 1960-71 | .49 | 10 |
| California veneer and plywood[1] | 2432 | $Y = 8.451 - 0.1138X$ | 7.0 | 1960-71 | .41 | 10 |
| | | $Y = 8.786 - 0.6451 \log X$ | 13.9 | 1960-71 | .58 | 10 |
| | | $\text{Log } Y = 2.172 - 0.0796 \log X$ | 13.1 | 1960-71 | .57 | 10 |
| | | $\text{Log } Y = 2.133 - 0.0143X$ | 7.2 | 1960-71 | .42 | 10 |
| Interior California sawmills and planing mills[1] | 2421 | $Y = 5.637 - 0.1468X$ | 223.6 | 1960-71 | .96 | 10 |
| Coastal California sawmills and planing mills[1] | 2421 | $Y = 6.770 - 0.1335X$ | 66.5 | 1960-71 | .87 | 10 |
| California pulp, paper, paperboard, and building paper[2] | 2611 | $Y = 17.858 - 1.1705X$ | 78.9 | 1960-71 | .89 | 10 |
| | 2621 | $Y = 19.373 - 5.4774 \log X$ | 58.5 | 1960-71 | .85 | 10 |
| | 2631 | $\text{Log } Y = 3.124 - 0.5329 \log X$ | 39.9 | 1960-71 | .80 | 10 |
| | 2661 | $\text{Log } Y = 3.014 - 0.1196X$ | 110.4 | 1960-71 | .92 | 10 |
| Seven selected California pulpmills and paper mills which consume wood[2] | | $Y = 6.201 - 0.4290X$ | 73.6 | 1960-71 | .88 | 10 |
| | | $Y = 6.781 - 2.0225 \log X$ | 61.3 | 1960-71 | .86 | 10 |
| | | $\text{Log } Y = 2.103 - 0.5933 \log X$ | 39.7 | 1960-71 | .80 | 10 |
| | | $\text{Log } Y = 1.978 - 0.1328X$ | 101.4 | 1960-71 | .91 | 10 |

NOTE: Equations use natural logarithms (base e).

[1] $Y$ = Employees per million board feet, $X$ = time (years).

[2] $Y$ = Employees per thousand bone-dry tons, $X$ = time (years).

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